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BACKGROUND PAPER: BLINDNESS IN THE DEVELOPING WORLD

INTRODUCTION

The World Health Organization (WHO) has estimated the blind population throughout the world at as many as 42 million people. Over 90 percent of all blindness is in the developing world.¹ Two-thirds of all existing blindness would have been preventable through basic public health and nutrition measures.²

A major difficulty in assessing the true extent of the problem of blindness is the state of the art in data-gathering in developing countries. This difficulty is compounded in the area of blindness by the multiplicity of definitions. For example, few of the people defined as "blind" in any country are totally blind. In the United States and Canada, 60 percent or more of those "blind" can read newspapers (with corrected visual aids). The definition also involves the perception of light, which then requires attention to the degree and efficient use of low vision.

Visual acuity at 3/60 (20/400)* precludes an individual from functioning effectively in a community without special assistance. However, many industrialized countries use the level of 6/60 (20/200) as the criterion for legal blindness, which widens the

1 WHO Chronicle, "Data on Blindness Throughout the World"
33: 275-283 (1979)

2 WHO

*That is to say, the individual can see at three meters what a normally sighted person could see at sixty meters (or twenty feet and four hundred feet respectively).

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definition considerably.

A report from the February 1979 meeting of the WHO Programme Advisory Group of the Prevention of Blindness estimates the blind population throughout the world at from 28 to 42 million-- depending on whether or not the definition of blindness was placed at 3/60 (the WHO criterion for international comparison) or at 6/60 (the standard generally used in the Americas).³ With older children and adults, WHO recommends that they be screened at a visual acuity of finger counting at three meters (3/60). Table I on page 3 defines the gradation in categories of visual impairment adapted from the International Classification of Diseases (WHO, 1977).⁴

In further defining the blind population, the WHO Advisory Group estimated the location of the respective populations in the developed and developing world as shown in Table II on page 4.⁵

3 WHO Chronicle, Ibid

4 Guidelines for Prevention of Blindness Programs
WHO, Asilomar Ca., October 1978.

5 WHO Chronicle Ibid. p.277

TABLE I

CATEGORIES OF VISUAL IMPAIRMENT ADAPTED FROM
THE INTERNATIONAL CLASSIFICATION OF DISEASES,
WORLD HEALTH ORGANIZATION 1975

	Category of visual impairment *	Visual acuity with best possible correction**	
		Maximum less than	Minimum equal to or better than
Low vision ↑	1	6/18 3/10 0.3) 20/70	6/60 1/10 (0.1) 20/200
		6/60 1/10 20/200	3/60 (finger counting at 3 metres) 1/20 (0.05) 20/400
		3/60 (finger counting at 3 metre) 1/20 (0.05) 20/400	1/60 (finger counting at 1 metre 1/50 (0.02) 5/300 (20/1200)
Blindness ↑	4	1/60 (finger counting at 1 metre) 1/50 (0.02) 5/300	Light perception
		No light perception	
		Undetermined or unspecified	
	9		

* If the extent of the visual field is taken into account, patients with a visual field radius no greater than 10° but greater than 5° around central fixation should be placed in category 3 and patients with a field no greater than 5° around central fixation should be placed in category 4, even if the central acuity is not impaired.

** For the first four categories of visual impairment, the different lines of figures in each box of the visual acuity columns represent the same level of acuity expressed according to different notations. The first line gives the notation used with the Snellen 6-metre scale (and, where applicable, the corresponding ability to count extended fingers at a set distance); the second line gives the equivalent notation used with the 20-foot scale; the third line gives the decimal notation.

TABLE II

ESTIMATES OF BLINDNESS PREVALENCE (RATES
AND ABSOLUTE NUMBERS) IN DIFFERENT GROUPS
OF COUNTRIES (OR AREAS) THROUGHOUT THE
WORLD

Group of countries (or areas)**	Total estimated population in millions	Estimated blindness (visual acuity less than 3/60)		Estimated blindness (visual acuity less than 6/60)	
		Prevalence rate (%)	Number of blind (in millions)	Prevalence rate (%)	Number of blind (in millions)
Developing (a)	2100	1.0	21.0	1.5	31.5
Intermediate (b)	1100	0.5	5.5	0.75	8.3
Developed (c)	800	0.2	1.6	0.3	2.4
Global total	4000	--	28.1	--	42.2

*The figures given in Table II are a minimum estimate; in certain areas or population groups higher rates have been reported, up to 3 or 5% or more. These estimates, based on available data, might well have to be revised as better and more comprehensive figures become available. This revision is particularly needed with regard to population included in group (a), for which blindness prevalence rates are higher and statistical data are more limited and less reliable.

** (a) Developing Countries where at least among the rural majority eye care has not yet reached (b) level. Because of shorter life expectancy, a smaller number of elderly people reduces overall prevalence associated with old age. Massive prevalence of trachoma, onchocerciasis, xerophthalmia, cataract, and accident-related blindness.

(b) Intermediate Countries at an interim stage of development, where blindness rate is not massively augmented by major causes in (a). Blindness rate estimated at .40-.65%. Critical factor is untreated cataract and undetected glaucoma.

(c) Developed Countries with advanced medical services where blinding infections are controlled and where most curable blindness is treated. Prevalence rates average between .15 and .25%. Critical factor is the proportion of population in the older group.

As can be noted from Table II, 94 percent of the total blind population are in the first two categories of development.

In setting national goals for acceptable rates of blindness, WHO has as its objective less than .5% of a population, with not more than 1% in any individual community.⁶ The following rates of blindness have been compiled to offer a perspective on the relative ranges of prevalence.⁷

Canada	0.1%
USA	0.2%
Haiti	1.3%
Afghanistan	2.0%
Egypt	2.6%
Chad (onchocerciasis endemic area)	3.2%
Morocco (trachoma endemic area)	4.1%

Rates of over four percent for regions endemic with onchocerciasis or trachoma--two major forms of blindness--are not unusual. In addition, rural areas are many times more vulnerable than urban--both in terms of population at risk and in having access to treatment--with variations as much as fourfold.

In terms of program intervention, the difficulties in delivering services to the blind, or in developing a system to prevent blindness, have not so much to do with the technology available,

⁶ Final Report Planning Group on Prevention of Blindness, PAHO, 12-14 Sept. 1979, Washington DC. DPC/PBL/1.0/79

⁷ WHO Chronicle Ibid.

but with the well-known barriers in delivering any service to the rural areas in the developing world. The delivery system is inadequate, with a minority of the population having access. This is attributed to limited resources (both manpower and financial), rudimentary communications and road networks, and political wills and national priorities.

The problems in access to services for the blind can be demonstrated in the case of cataract intervention. Cataract is a universal and common cause of blindness, and the intervention indicated is surgery. Surgery can be effective in restoring sight in over 90 percent of cases. Although innovative field delivery programs are being initiated to expand the number of people treated, an outreach program and the training of intermediate level workers are still required.

The majority of the populations in developing countries are in the rural areas. The future lies in developing mechanisms to reach those people, identify those at risk, and service them.

Historically, the field of blindness has been divided into professional disciplines of education and rehabilitation of those already blind, and more recently, blindness prevention. This paper will examine the variety of interventions and types of past research separately for each discipline. In listing specific agency programs and future research recommendations, the three areas will be treated as a unit. The focus of the research and recommendations will center on work in the developing countries.

SECTION I

EDUCATION FOR THE BLIND

TYPES OF PROGRAMS

Historically, education services for the blind have tended to single out the blind as handicapped or disabled persons that could only be served in separate facilities or settings.

Until recently in the developing nations, blind children have had very limited access to the educational system in their countries because of a severe lack of resources and interest in integrating them into the mainstream of society. With the low standard of living of most developing countries, mere survival is what counts in the ordering of national priorities--and educational services or opportunities have been at or near the very bottom of the list. However, this system is changing slowly, and a few integrated and special education programs are now available.

The following is a survey of educational programs that have been--and are--available to meet the needs of the blind:

Braille - In the 19th century, the French educator Louis Braille developed a reading system for the blind. Traditionally, programs in education for the blind have consisted of special schools for the blind where they would participate in years of academic education through the braille system. Students were usually between five and 20 years of age, occasionally older.

Low Vision - As mentioned earlier, few people designated as blind are totally blind. There has been increasing interest in

helping each person make the best use of whatever vision he or she may have (i.e. through the use of special ocular or visual aids, through cassettes, etc). Techniques in the efficient use of low vision are currently part of the recommended training for teachers of the blind. Intervention on the part of international agencies includes both short-and long-term consultants who give courses to teachers of the blind. Courses range from a few days to two years, and have been offered throughout the world.

Expanding Traditional Curriculum in Schools for the Blind -

It has been recognized that purely academic education in schools for the blind is not practical. Hence, it is now recommended that all special schools extend their curriculum to include: mobility training, personal hygiene, daily living skills, sex education, vocational training, etc. It is expected that blind or low-visioned students must, when leaving their formal education, be prepared to function independently within their respective families and communities.

Integrated Education - With less than one percent of the blind youth under sixteen years in developing countries now in school, efforts have been made to provide education to larger numbers through integration of the blind in regular schools, or 'mainstreaming.' To succeed in competition with the normally sighted, the blind or low-vision student needs a few hours each week of special instruction and equipment from a specially trained teacher of the visually impaired. Although integrated education began around 1900 in the United States and now serves 75 percent

of their visually impaired, it has been accepted internationally only in the last 25 years. International agencies and national bodies have sent short and long-term consultants to establish this system in at least 40 countries including: India, Senegal, Indonesia, Iran, Nigeria, and Portugal.

Non-formal Education - A system of non-formal education for blind adults has been used for 50 years in the United States, Canada and England. It involves instruction to the visually handicapped person in his or her home on daily living skills, mobility training, handicrafts, and participation in family activities. During the last eight years, non-formal education has been offered in developing countries to blind children as well as adults. It does not include formal instruction on braille reading. (See Section II on rehabilitation for further discussion on types of non-formal intervention.)

RANGE OF FUNDING

Funding depends on the extent and length of the education project. A six-week course given by an international agency in Tunisia in 1969 for teachers of schools for the blind cost \$12,800. This amount covered salaries and expenses of three instructors, plus expenses of the 58 participants from Tunisia, Algeria, Morocco, and Libya. A two and one-half year integrated education project begun in 1974 in Senegal with one full-time consultant and three short-term consultants cost an international agency \$70,000. It cost the Senegalese Government \$200,000. A recent two and one-half year project on teacher training, upgrading special schools and introducing integrated education and mobility

in Indonesia sponsored by USAID cost \$300,000, plus a significant contribution from the Indonesian Government.*

RESEARCH: STATE OF THE ART

Aside from a current attempt to appraise the effectiveness of an integrated education program in Indonesia, no research has been done on education of the blind or low-visioned population in the developing countries. There are some pilot projects with experimental components, but adequate research methods are not being used. With regard to institutional interest from the developing countries concerning the blind, the major request has been for surveys to locate the blind and register them: that is, to conduct case-finding surveys. The requests for assistance are usually for equipment and trained personnel to improve special schools, and to develop integrated education, vocational training, low-vision clinics, etc.

SECTION II

REHABILITATION FOR THE BLIND

TYPES OF PROGRAMS

Mobility--physical independence--has been a basic concern of the blind for many years. In the past, blind people have used three systems to get around: holding the hand, arm, or

*The cost estimate for any of these programs in international assistance directed to the blind or blindness prevention should be considered as "start-up" costs. There is the expectation that the program will be an ongoing part of the national system once the "project" is phased out.

shoulder of a sighted guide; using some sort of stick; or following a dog, goat, or calf by a rope or harness.

In the 1940's, a systematic approach to cane travel was developed in the United States. It involves using a long cane and swinging it in an arc in front of the body as one walks. Sighted instructors are trained to teach the blind this systematic approach in orientation and mobility (O&M) courses, during which the student is blindfolded while learning O&M skills. In turn, they teach blind persons these mobility skills which lead to physical independence.

This system is now accepted internationally, and has spread to at least 30 countries of the world. Courses for sighted mobility instructors have been offered in developing countries by international agencies since the 1960s. They range in length from five weeks to five months.

General rehabilitation for the blind, however, has as its major goal, the full integration of the blind and visually handicapped individual into the economic and social life in both rural and urban areas. In addition to independent travel, blind persons need to develop skills in personal care, inter-personal relationships, and work activities. Basic restorative services and low vision assessment, should also be provided.

Traditionally, most rehabilitation services have been concentrated in the urban centers of developing countries.

Urban Programs - Rehabilitation programs in urban areas have been established along the lines of the following models:

(1) Rehabilitation Center--This is a comprehensive facility,

which can be residential, and is designed to offer both an evaluation of the individual's training needs and the provision of a rehabilitation training program. Evaluation is the assessment of the person's present level of functioning and an assessment of needs in the medical, social, psychological, and vocational areas. Treatment consists of rectifying those areas demonstrated as deficient during the evaluation with training in communication skills, orientation and mobility, activities of daily living, manual dexterity, and pre-vocational or vocational skills. Services involve medical treatment, low vision assessment, social work, rehabilitation counseling and/or vocational placement.

(2) Sheltered Workshop--These facilities, which sometimes are operated in conjunction with a rehabilitation center, provide employment opportunities for those blind persons who would otherwise not be working. The eventual placement of the person into competitive employment may or may not be an objective of the center.

(3) Work Activity Center--This center provides blind individuals who are unable to work in competitive or sheltered employment with a place to go during the day to be physically and socially active. Activities include traditional crafts identified with the blind (broom-making, basket weaving etc.), for which they may receive some monetary compensation. Unlike a sheltered workshop, the work output is often well below that demanded by competitive employment.

(4) Employment Exchange--This is a service generally operated as a component of a government employment exchange. Special

employment exchange personnel work with the blind in helping to place them into competitive employment. An evaluation of each person's assets and abilities is usually made by the exchange prior to placing the blind person into employment. Follow-up services are provided to insure the client has been suitably placed.

The above models have been developed for implementation in an urban setting. There is a growing awareness that such programs are not reaching the great majority of blind people who reside in the rural areas of developing countries. New and innovative programs are being attempted to correct this imbalance.

Rural Programs - The following list comprises some of the models which are attempting to meet the rehabilitation needs of the rural blind:

(1) Agricultural Training Center--This is an in-place institution, where blind persons reside during their training program. This program concentrates on helping blind persons become independent after they return to their villages. Medical and educational assistance may also be included in the services provided by the center. Placement officers usually are required to assist in the resettlement of blind persons once they return to their villages.

(2) Rural Center With Extension Services--This model offers a central training center where persons are brought for intensive, short-term training and services. Extension workers then continue services and training in each person's village. A more conscious attempt is made to maintain contact with each

person's family and community than with the agricultural training center. More intensive and ongoing follow-up services are provided once persons return to their villages.

(3) Rural Cooperatives--This is a small village cooperative which employs blind persons. Its main focus is profit, although training may be part of the program for new employees. Management or some supportive contact is generally maintained with a rehabilitation agency for the blind, which provides special services (i.e., medical and social).

(4) On-site Rehabilitation Program--A rural worker contacts blind persons in their villages and provides on-site rehabilitation services and training. Although employment in the traditional sense of earning direct income is seen as a possible goal, the main focus is to integrate blind persons into active family and village life. This includes training in all the skills blind persons require to become independent (i.e. mobility training, daily living activities, performing routine household and village tasks, etc.) The family and community is included in each blind person's rehabilitation program to the fullest extent possible.

RANGE OF FUNDING

The types of projects in the area of rehabilitation of the blind and visually handicapped vary greatly in size and scope. These projects can involve the upgrading of staff at an existing facility, or the building of a new facility itself. It can involve the establishment of a new system (i.e., on-site delivery of services in rural areas), or strengthening the existing program through the provision of new equipment and in-service staff

training. Foreign expertise may be brought in for short-term consultancy, or for residence during the life of the project. Hence, the estimated funding will vary significantly.

Rehabilitation projects for the blind usually require the services of a foreign consultant incurring such expenses as salaries, per diems, and travel costs. Providing only a modest amount of new equipment often requires the use of foreign consultants to provide some on-site training so that the full benefit of the new equipment can be achieved. The length of time of a project will vary from a minimum of three weeks (quick training course) to five years (to establish a national system of rehabilitation).

The following time-cost estimates have been suggested only to give the reader a broad idea of the range of costs:

<u>Type of Project</u>	<u>Estimated Funding</u>	<u>Estimated Length</u>
1. Urban Rehabilitation Center	\$1,500,000	4 years
2. Agricultural Training Center	900,000	3 years
3. On-Site Rehabilitation Scheme	40,000	1 year
4. Training Course (1 consultant)	50,000	1 year
5. Training Course (3 consultants)	23,000	2 months
6. Training Course (1 consultant)	9,500	3 weeks

These costs do not include the time spent in planning the course or program, or the time involved in follow-up, both of which are essential to the success of the project.

RESEARCH: STATE OF THE ART

Traditionally, research in the area of rehabilitation of the blind has been non-existent in most developing countries. The great concern has been to provide some type of service as quickly as possible where none existed before.

India is a country that is unique in this respect. The Indian Government is funding a multi-million dollar National Center for the Blind in Dehra Dun that will have a rehabilitation research unit. Already the ultrasonic mobility device is being researched in an attempt to provide India with the capacity to produce such a device locally.

Generally, specific program or project evaluation is done to assess costs, results, outputs, effectiveness, etc. However, this evaluation has been for use by the respective sponsors and is not usually for international consumption. Recently, Christoffel Blindenmission sponsored a conference to record international efforts in rehabilitation in rural areas of developing countries.

In terms of program, the primary interest in the past has been to develop comprehensive rehabilitation centers for all disability groups similar to those found in the West. These were seen as a sign of development and sophistication. However, because of the great demands on their limited financial resources, some developing countries have incorporated rehabilitation services for the blind with those of other handicapped persons. In such programs it has been found that the blind clients do not fare as well as other disability groups, primarily because the rehabilitation needs of the blind are very different.

SECTION III

BLINDNESS PREVENTION

TYPES OF PROGRAMS

Increasingly, blindness prevention has become recognized as a primary area for intervention in the field of blindness. The four major categories of preventable blindness in developing countries designated by WHO are: cataract, onchocerciasis, trachoma, and xerophthalmia. As already indicated, at least two-thirds of the existing blindness could have been prevented through basic public health and nutrition measures. The discussion of types of prevention programs will focus on these four blinding diseases.¹

(1) Cataract--A cataract is a lens opacity, varying in degree of density. Although due to numerous causes, it is generally associated with aging. Senile cataract is common throughout the world. Progressively blurred vision is the only symptom. Congenital cataract, although common, may not cause significant visual loss. Cataractous lenses are characterized by edema, protein alteration, and necrosis. Although most cataracts are not visible to the casual observer until they become dense enough to cause blindness, it can be seen in its earliest stages with an ophthalmoscope, loupe, or slitlamp.

There is no medical treatment for cataract. Lens extraction is indicated when visual impairment interferes with the patient's

¹Credit to the following disease descriptions to: Vaughan D. and Asubry, T. General Ophthalmology, 8th Edition, Lange Medical Publications, Los Altos, CA. and Communicable Disease Control, APHA, Washington D.C.

normal activities. Surgery definitely improves visual acuity in well over 90 percent of the cases.

It has been observed that the age of onset for senile cataracts in developing countries is at least ten years earlier than in the developed world. Wear and tear on the eye has been suggested as a possible reason.

Intervention through surgery has had a history of success. One critical factor is the necessity of follow-up with glasses (or corneal contact lens) that are essential for renewed vision after surgery. Those surgery programs in the developing countries initiated by international sponsors have been primarily through mobile eye camps. This type of service involves a team camping in a certain area, executing hundreds of lens extractions in a short period of time, often with the assistance of paramedics. Another approach has been the use of "flying doctors", who are a group of expatriate surgeons flown into the countries to assist in the camps during surgery. However, with the increased experience, training, and use of paramedics, cataract surgery is often routinely handled in the village eye camps by national agencies (although usually with continued funding and assistance from international agencies).

RESEARCH: STATE OF THE ART

In developing countries, there have been studies on the effectiveness of field surgery (i.e. complication rates), the use of paramedics, and costs of surgery. These evaluations have been primarily program-oriented. For example, the International Eye Foundation has an extensive comprehensive eye care project in

Kenya: part of the protocol is determining the effectiveness of the cataract surgery and use of intermediate-level workers.

Institutional interest in cataract research in the developing countries vary: India and Kenya are two countries that have devoted considerable effort to the field. Since its operation is seemingly straightforward and effective, cataract intervention has an international appeal for sponsors.

(2) Onchocerciasis--This disease, commonly known as "river blindness," is a serious parasitic disease caused by a number of microfilariae under the skin, the most important lesions being those of the eye which lead to serious loss of vision and blindness. The official figure of 20 million people infected is considered a gross underestimate. The disease is widespread in Africa, Yemen, Mexico, and Central and South America.

The disease is transmitted by the vector Simulium black fly. The fly bites an already infected human, ingests the microfilariae, bites another human and injects larvae into them, which form fibrous nodules. The fly itself breeds in fast-flowing shallow streams.

Control through killing the parasitic worm in the human (*Onchocerca volvulus*) is not feasible at this point, due to the side-effects (including death) of the drugs presently available. Therefore, control is through the vector--the Simulium flies. Mass insecticide spraying programs have been undertaken to kill the disease-carrying flies and their larvae. Since many sites are inaccessible by land, insecticide has been applied through

the use of aircraft. The recommended insecticide is the biodegradable Abate. Cutting down vegetation near the river also helps in eliminating breeding sites.

Onchocerciasis is, however, a difficult disease to control. A massive program in the Volta River Basin has had some success. The fly is showing a tenacity and endurance hitherto unsuspected. In a vector control program in Kenya, follow-up examinations for continued presence of infection 18 years following the interruption of transmission in a protected area, showed that the parasite may live as long as 15 years, and that the disease in those previously infected continued to take its course.

RESEARCH: STATE OF THE ART

Research has primarily focused on the development of a successful chemotherapy intervention against the parasite, once a person is infected. Some attention also has been given to vaccination possibilities. These approaches deserve priority attention, although unsuccessful to date. The Onchocerciasis Control Programme, jointly sponsored by WHO, FAO, UNDP, and the World Bank, is an ambitious program headquartered in Upper Volta, which coordinates research and intervention.

After much investigation in the comparative advantages of various insecticides against the vector, Abate--a biodegradable chemical--was selected. Although demonstrating an effectiveness in reducing the blackfly population in a particular area, the fly has been found to be expanding its territory, demonstrating flying ranges heretofore unknown to the investigators.

Considerable international interest and funding has been drawn together, concentrating on the high-risk countries in the Volta River Basin area.

The Onchocerciasis Control Programme is a multi-million dollar effort that includes both research and intervention. Individual scientists have been awarded small grants for investigation into the feasibility of drugs in treatment (i.e., \$130,000).

(3) Trachoma-- This disease is the world's leading cause of blindness: it is estimated that over 400 million people in the world are afflicted with trachoma, with two million blinded and eight million at risk of blindness. Regional variations in prevalence are explained primarily in terms of the personal hygiene and standards of living, but also associated with dry and dusty areas. It is widespread in the Middle East, Asia, the Mediterranean area, and parts of Africa and Latin America, differing in intensity and severity. An infectious disease, it is spread by direct contact or fomites (soiled material) with ocular discharges. The transmission is facilitated but not dependent on flies. The infectious agent is, Chlamydia (Bedsonia) trachomatis, an intracellular parasite.

Trachoma is characterized by conjunctival inflammation with lymphoid follicles and papillary hyperplasia. The disease progresses through four stages, which can result in conjunctival scarring and entropion of the upper lid. If there is associated trichiasis (turning in of eye lashes), the aberrant lashes may rub the cornea leading to corneal ulceration. Bacterial conjunctivitis is commonly present, increasing severity and communicability of the disease.

Treatment intervention involves the use of antibiotics, and possible surgery (the correction of lid deformities--trichiasis/entropion). However, the principal recommended prevention is through improved hygiene behavior and primary eye care.

RESEARCH: STATE OF THE ART

Research has been clinical, epidemiological, and microbiological in the field of trachoma. A key resource is the Proctor Foundation in California, which has had a long-standing study of the disease in sample villages in Egypt and Tunisia. The Foundation's major institutional commitment, in fact, is investigation into all phases of trachoma (laboratory, treatment, prevalence, etc.)

There is considerable institutional interest in developing countries where the disease is prevalent, primarily in assessment and treatment.

(4) Xerophthalmia-- Xerophthalmia is an ocular-symptomatic vitamin A deficiency disease. It is characterized by such ocular signs as night blindness, xerosis (drying) of the conjunctiva and cornea, Bitot's spots (foamy material on the conjunctiva), and ulceration of the cornea. This nutritional deficiency can result in the complete deterioration of the cornea into irreversible blindness. It is assumed to be most prevalent in the "rice belt" of Asia, where it is estimated that as many as 250,000 children each year may become blind due to the disease. It has also been documented as existing in geographic pockets elsewhere (i.e., Africa and Latin America). It is generally thought to be associated with malnutrition. The high risk group is composed of children from birth through six years of age, especially the sick and malnourished, who are subject to frequent infections and defective immunological defense mechanisms. Measles and diarrhea are two conditions which seem to be of particular concern in the development of the disease.

Xerophthalmia intervention includes:

- 1) periodic distribution of vitamin A capsules (200,000 IU) every four to six months to children, and every two months to lactating mothers, for prevention;
- 2) immediate clinical treatment with massive doses of vitamin A for those children who demonstrate signs and symptoms of the disease;
- 3) Nutrition education for mothers about the importance and sources of vitamin A-rich foods;
- 4) fortification of foods with vitamin A, where feasible; and
- 5) training and education of health and medical personnel in the recognition, prevention, and treatment of the disease.

RESEARCH STATE OF THE ART

Considerable research has been carried out in the field of xerophthalmia. Recently, under the direction of Helen Keller International (HKI), a major three-year research study was conducted into the etiology of the disease, its prevalence and possible program intervention.

A number of national prevalence surveys have also been undertaken by HKI. Preliminary assessments as to the extent of the problem are currently planned for Northern Africa by WHO/Nutrition Unit.

Cost-effectiveness and program evaluation studies have been undertaken by HKI (vitamin A capsule distribution programs in Indonesia and Haiti) and Cornell University (cost-effectiveness

of three modes of intervention in the Philippines).

Institutional interest in developing countries has been demonstrated in countries where xerophthalmia is prevalent, primarily in Asia. The above research and prevalence surveys were executed in collaboration with the respective national governments.

Fortification of widely used foodstuffs with vitamin A is also being studied as a way to prevent nutritional blindness. Research leading to the fortification of sugar with vitamin A has been extensively carried out in Guatemala by the Institute for Nutrition in Central America and Panama (INCAP).

RANGE OF FUNDING

The range of funding for xerophthalmia research depends on the type of program developed. Also, it generally involves external funding, internal support (local funds, in-kind contributions, etc.), and technical assistance.

The extensive three-year research project in Indonesia (cited above), which examined the etiology, prevalence and the prevention/treatment of xerophthalmia (through three separate studies carried out simultaneously), cost an average of \$340,000 in external funding annually. These expenditures included costs for an expatriate project scientist and administrative officer. Another extended project in Kenya, which included both research and treatment, and involved the development of an eye health care intervention system with the use of paramedical personnel, averaged about \$300,000 external funding per year. This also included an expatriate project scientist and administrator.

Assessment surveys which involve technical assistance and executed by local staff, have averaged around \$30,000 to execute, depending on the size of the country, location from agency headquarters, etc. These have been disease-specific surveys (i.e., xerophthalmia, trachoma), not general visual impairment examinations. A recent program evaluation in Haiti that included a prevalence survey cost of \$21,000, with an expatriate consultant part-time, and a team whose indigenous leadership, had costs already covered in its ongoing program budget.

SECTION IV. Recommended Research in the Field of Blindness

General research needs for assessment and integrated service delivery will be presented in Part A on the following page. These will be followed by specific recommendations in the three fields of education, rehabilitation, and blindness prevention (Parts B, C and D).

In light of the limited resources and capacity to reach populations in need, it has been recognized that the traditional Western models of systems for educating and rehabilitating the blind are not necessarily appropriate for the developing countries. In fact, their appropriateness for the Western world itself has been challenged in terms of costs, efficiency, and maximizing the potential of integrating the blind person into the social and economic system where he or she lives.

As indicated earlier, the problems involved in the development and implementation in any social or health service in a developing country also apply to the development of a system of program delivery with regard to blindness. Some of these problems relate to:

- identifying those at risk from blindness
- ascertaining the extent and geographic distribution of the problem
- reaching those at risk, making services accessible
- training at intermediate or auxiliary levels due to shortage of manpower
- limited resources, required cost-effective programs
- lack of evaluation programs to measure impact and efficiency.

Therefore, research needs to be directed to examining and improving systems of intervention into the control and reduction of blinding diseases. Additionally, especially for blindness prevention, there is a need for further investigation into the etiology of the blinding disease and possible measures for their prevention.

Part A. General Research Needs

1. Assessment

a. The need for defining optimal, simple, and reliable methodology for use in field surveys to assess the amount of visual impairment in a population, and its geographic distribution. This would include the development of diagnostic criteria and determining the reliability of using intermediate level workers to execute the surveys.

b. The feasibility of combining "case-finding" techniques into blindness prevalence surveys (to locate blind clientele).

c. The feasibility of assessing specific causes of blinding disease (i.e. trachoma, xerophthalmia) at the same time as a general assessment of visual impairment in a population is undertaken.

d. The development of techniques for surveillance, including means of systematic collection of data on selected eye diseases and realistic record-keeping forms; and monitoring effects of interventions.

2. Service Delivery

a. The feasibility of combining the skills and techniques for education, rehabilitation, and blindness prevention into one simple program as a comprehensive approach to blindness.

b. The feasibility of integrating such a comprehensive program into existing delivery systems (i.e., health, education, and/or welfare).

c. Analyze staff requirements to develop policy, plan, and implement such a program in terms of educational background, technical skills, experience, etc.

d. Development of criteria for the selection of auxiliary workers best equipped to function in such a program, including educational levels and task capabilities.

Part B. Education of the Blind

a. Studies of the process for decisions regarding the selection and introduction of the most appropriate type(s) of educational services into a developing country.

b. Research on simple, cost-effective approaches for the identification and initial screening of visually handicapped children.

c. Studies in the cost-effectiveness and long-term human and economic benefits of various educational models (residential, integrated, non-formal).

d. Evaluation, in terms of cost-effectiveness, of interventions which provide direct services to preschool visually handicapped children and their families. For instance, particular

attention should be placed on the evaluation of several models for the rural delivery of non-formal education services to visually handicapped children, with emphasis on:

- administrative structures (potential for integration into existing service delivery systems);
- criteria for selection of field sites to maximize replicability;
- content of training curriculum and scheduling segment for field workers (and clients);
- criteria for selection of field workers for training, particularly education and interpersonal relationships;
- identification of baseline skills required for the integration of the visually handicapped into indigenous vocational training programs for the sighted.

e. Field testing of various types of materials (i.e., flip charts, comic books, film strips, radio education programs) for use with parents, siblings and community members.

f. Comparative studies of training approaches directed toward those working with the visually handicapped (i.e., in upgrading existing teaching skills, and/or introducing new skills in orientation and mobility techniques, low vision, etc.)

g. The evaluation of models for linkages between school systems and trade/vocational programs to service the blind or low-visioned.

Part C. Rehabilitation

a. Cost effectiveness of various rehabilitation systems according to an established criteria of what defines a rehabilitated blind person.

b. The extent to which it is feasible to integrate a type of community-based, on-site rehabilitation service into an existing rural delivery system of services, education, social welfare, health, etc.

c. Cost-effectiveness of in-place agricultural training program versus itinerant service.

d. Investigation of ways to include blind persons into on-going government development schemes (i.e., agricultural, industrial), and the political feasibility of doing so; and how can blind persons be integrated into government technical training programs for employment within these development schemes.

e. Effects of culture, stigma, or prejudice on employment opportunities for the blind in developing countries and how best to counter negative factors.

f. Determine feasibility of producing highly technical aids and devices for the blind (i.e., opticon, laser cane, ultrasonic aids, etc.) in developing countries to lessen costs and broaden market.

Part D. Blindness Prevention

1. Integrated Eye Care and Preventive Services

a. Feasibility of combining diagnostic, therapeutic and preventive activities into a single program, involving the three major levels of health delivery:

--primary (community level workers delivering primary eye care);

--secondary (eye care delivered by ophthalmologist or other suitably trained health personnel supervised by physician with ophthalmic training);

--tertiary (final medical referral center).

b. Determination of the degree and manner of interdisciplinary cooperation required to integrate blindness prevention services--including a system of eye health care--into a comprehensive health services program.

c. Development of criteria for the selection of auxiliary, medical, and specialized personnel in eye care required to function in such a comprehensive health services program, including educational levels and task capabilities.

d. Development of curricula for training personnel at the various level in integrated primary (eye) health care systems.

e. Effectiveness, efficiency, and costs of different systems of eye care delivery.

2. Cataract

a. Testing of measures to reduce the time of convalescence required (i.e., through different surgery techniques or instruments.)

b. Development of guidelines for eye camp procedures.

c. Further research into the etiology of cataracts: for example, reasons for the earlier age onset in some developing countries.

3. Onchocerciasis (See Annex I for more detailed description of research needs)

a. Study in the epidemiology of ocular lesions (their incidence and progression, to indicate factors of blindness).

b. Study in the epidemiology of the dynamics of transmission, including research on the parasite (*Onchocerca volvulus*),

the vector (Simuliids or "blackflies"), and techniques for improved parasitological diagnosis and immunodiagnosis.

c. Urgent need for chemotherapy research to determine effective drug (macrofilaricide), with therapeutic schedules to minimize side-effects, and which can be safely administered by medical assistants.

d. Establishment of criteria for treatment of heavily infected cases at risk from blindness.

4. Trachoma

a. Research into more effective chemotherapy which could be safely administered by medical assistants, and which would prevent blindness by reducing the reservoir of chlamydial infection in the population.

b. Evaluation of surgical techniques to correct entropion and trichiasis.

c. The feasibility of integrating health education and sanitation facilities in maximizing trachoma prevention programs.

5. Xerophthalmia (See Annex II for more detailed description of research requirements)

a. Research in mechanisms of increasing vitamin A intake: through alterations of the vitamin A content in diet, through periodic supplementation of vitamin A, and through fortification.

b. Refinement and validation of indices to define vitamin A deficient population at risk of functional impairment (i.e., serum level).

c. Improve methods in epidemiologic assessment (i.e., clinical diagnoses standards, levels of vitamin A status, etc.)

d. Study of the impact of periodic vitamin A distribution programs on reduction of nutritional blindness.

e. Studies in controlling those factors that impair vitamin A nutriture (i.e., intestinal infections, protein-energy malnutrition).

f. Evaluation of the process and operation of periodic vitamin A capsule distribution programs.

g. Studies in controlling ocular factors of xerophthalmia contributing to visual impairment (i.e., that contribute to ulceration)

h. Evaluation of relative cost-effectiveness of massive dose approach and fortification approach in the prevention of nutritional blindness and vitamin A deficiency.

i. The comparative evaluation of communication strategies in nutrition education as it relates to vitamin A deficiency and nutritional blindness.

j. Assessment of the correlation of socio-economic factors with incidence rates of xerophthalmia.

k. Research in the role of vitamin A deficiency and malnutrition in the etiology of corneal disease associated with measles.

SECTION V. Resource List of Agencies for Further Contact Concerning Education, Rehabilitation, and Blindness Prevention in the Developing World

- I. Key Agencies: Major contribution in the field of blindness in the developing world

A. Nongovernmental

1. Christoffel Blindenmission
e.V. Nibelungenstr. 124
D-6140
Bensheim 4
West Germany

Mr. Wolfgang Stein, Executive Director

A West German agency which operates in 58 countries around the world. Its emphasis is on the prevention of blindness and in the treatment of eye disease, but substantial attention is also paid to the incurably blind through support to education and rehabilitation.

2. Helen Keller International, Incorporated
22 West 17th Street
New York, New York 10011
U.S.A.

Mr. Harold G. Roberts, Executive Director

This organization is the oldest U.S. based voluntary agency which works to combat blindness and eye disease in the developing countries. It offers technical assistance to governments and organizations in their efforts to enable blind and visually impaired citizens to become useful, contributing members in their community. They train local personnel to do the necessary field work, and to take part in evaluating project effectiveness.

PROGRAMS: This agency has three major objectives:
(1) Prevention of eye disease and blindness, especially among malnourished preschool children in developing countries. Increased attention is being given to blindness prevention through intervention at the primary eye care level to include training of field workers in the recognition, treatment and prevention of eye disease. HKI's main blindness prevention effort is directed at the preventing, treating and reversing the blinding effects of xerophthalmia. The agency is involved in developing low-cost, high-yield methods for prompt delivery of vitamin A to children with early signs of nutritional blindness; provides instruction and training materials for medical, health and nutrition personnel; conducts nutrition education programs for mothers; and is

involved in studies of the feasibility of fortifying widely used local foodstuffs with vitamin A (2) Education of blind and visually disabled children. Trains teachers and administrators to provide and improve educational services for visually handicapped children; advises technicians and volunteers on production of braille books and educational aids; introduces new services, such as integrated education in which visually handicapped children attend schools for the sighted, receiving special instruction and materials; organizes courses and conferences on request of specific countries; and holds international seminars to which representatives of many countries are invited. (3) Rehabilitation of blind adults. Conducts in-depth studies of the conditions and needs of the blind in developing countries and makes recommendations to governments concerning establishment of rehabilitation services for blind adults; cooperates with national governments and local agencies in setting up courses to train rural field workers in low-cost rehabilitation of the blind in village homes and communities; develops programs for counseling families of visually handicapped children.

3. International Eye Foundation
7801 Norfolk Avenue
Bethesda, Maryland 20014
U.S.A.

Robert Meaders, M.D., Medical Director

Sends instructors to developing countries to train ophthalmic assistants in basic eye health care; undertakes health education programs relating to eye care and nutrition. Initiates blindness prevention projects, i.e., Kenya - school screening programs to detect and prevent trachoma; in its programs to train manpower and develop facilities for delivering eye care in rural areas, particular stress is placed on recognition, treatment, and prevention of nutritional blindness. Conducts prevalence surveys of eye disease.

4. Operation Eyesight Universal
P.O. Box 123
Calgary, Alberta T2P 2H6
Canada

A Canadian Charitable Trust which primarily provides assistance to eye camps and for eye care in developing countries. In India and Bangladesh, they provide

massive dose capsules of vitamin A to children with ocular signs of xerophthalmia, refer them to the nearest treatment center, and discuss the relationship of the eye problem to faulty diet. In Kenya, they have initiated school programs to detect the beginnings of trachoma and prevent this cause of blindness.

5. Royal Commonwealth Society for the Blind
Commonwealth House
Haywards Heath
Sussex RH 16 3AZ
England

Sir John F. Wilson, C.B.F., Director

The Society has national committees in 49 countries. It works in partnership with governments and local organizations, chiefly in Asia, Africa and the Middle East, in extensive programs through eye camps and mobile units to restore sight lost by cataracts and provide general ophthalmic care. In education, the emphasis is on expanding provision for the blind students within the general educational structure. The Society supplies financial grants, equipment for classroom and leisure, sponsorship of the poorest blind children and the training of teachers. It also provides support for employment projects for urban workers, farmers and village craftsmen. A trust has been established to broaden employment opportunities for blind students who leave school. An endowment fund supports projects designed to help blind women in education, employment and social life. It provides leadership and administrative support for the International Agency for the Prevention of Blindness, of which the Society's Director, Sir John Wilson, is President. The agency is at the center of a world movement to preserve sight and control the four major causes of needless blindness in the developing world: xerophthalmia, cataracts, onchocerciasis and trachoma.

B. Inter-governmental

1. World Health Organization

a) Nutrition Unit
WHO
1211 Geneva 27
Switzerland

Dr. E.M. DeMaeyer, Medical Officer

This unit has special responsibility for the control of

vitamin A deficiency, the major cause of xerophthalmia. Provides technical assistance and funds to countries in assessing the extent of the problem, planning interventions and carrying out research.

- b) Onchocerciasis Control Programme
B.P. 549
Ouagadougou, Upper Volta

Dr. R.I. Thylefors

This multi-million dollar programme is jointly sponsored by WHO, FAO, UNDP and the World Bank. Seven West African countries in the Volta River Basin joined together to fight the disease in a coordinated effort: Benin, Ghana, Ivory Coast, Mali, Niger, Togo, and Upper Volta. The program consists of treatment, intervention, and research. The intervention is primarily through the massive spraying with insecticide of an area more than 700,000 square kilometers; monitoring takes place by mobile teams. Research is in the search for an effective drug for treatment, vaccine for prevention, and in the epidemiology of the disease.

- c) Programme for the Prevention of Blindness
WHO
1211 Geneva 27
Switzerland

Dr. M.L. Tarizzo, Program Manager

This program assumes major responsibility on a global scale for technical assistance and leadership in the field of blindness prevention. To date, five collaborating centers have been designated at the regional level, with more planning in the future.

- (i) The Eye and Ear Hospital
"Dr. Rodolfo Robles V."
Comite Nacional Pro-Ciegos
2a. Calle A 35-34, Zona 11
Guatemala,
Guatemala

Dr. Luis N. Figuero, Medical Director

It is the tertiary level of the Medical Division of the National Committee for the Blind and the Deaf. It covers all aspects related to the problems of vision. Its programs, carried out by a multidisciplinary team, include: Prevention of blindness;

treatment of eye diseases, sight conservation, referral and follow-up of irreversible cases. To achieve its objectives, it trains ophthalmologists (doctors from other Central American countries avail themselves of this resource), technical personnel and auxiliary personnel. The principle focus is on preventive eye health. Holds conferences, seminars and refresher courses. A professional exchange of resident doctors is being carried out between the Wilmer Institute of The Johns Hopkins Hospital and the Eye and Ear Hospital "Dr. Rodolfo Robles V." The Medical Division promotes and carries out research. With the cooperation of some international organizations, it promotes the search for possible solutions to the control of unnecessary blindness.

- (ii) The International Center for Epidemiologic and Preventive Ophthalmology
The Wilmer Institute
The Johns Hopkins Hospital
Baltimore, Maryland
U.S.A.

Dr. Hugh Taylor, Co-Director

The new Center will undertake original clinical and epidemiologic studies on the major causes of blindness and their control; make available a range of consultative services on study design, survey methodology, and design and evaluation of blindness control programs, and provide training opportunities for investigators and health workers urgently needed in this field.

- (iii) National Eye Institute
National Institutes of Health
Bethesda, Maryland 20014
U.S.A.

Dr. Carl Kupfer, Director

As a WHO Collaborating Centre for the Prevention of Blindness, it will participate actively in the development of activities for prevention of blindness with special emphasis on developing and evaluating the research bases that will be a necessary prerequisite from which to launch low-cost multidisciplinary service

programs aimed at delivery of eye care to all; provide facilities for the training of personnel in epidemiology and biostatistical techniques; conduct applied field research on the epidemiology, management and operational aspects of avoidable blindness; foster a multidisciplinary approach to the promotion of eye health and to the delivery of eye care to all; participate in the collection, elaboration, and distribution of pertinent information; and provide upon request the advisory services and expertise which might be required and are available.

- (iv) WHO Collaborating Center for Prevention of Blindness and Trachoma
Francis I. Proctor Foundation for Research in Ophthalmology
University of California
San Francisco, California 94143
U.S.A.

Dr. Chandler R. Dawson, Director

The main activities of the center comprise: supplying "pedigreed" serotypes of Chlamydia trachomatis strains and reagents diagnosis; field studies on blinding trachoma particularly in North Africa; and long- and short-term training in the clinical and laboratory research techniques relevant to blinding trachoma and other blinding eye infections.

The aims of this newly designated Collaborating Centre will include: identification of problems encountered in ongoing blindness prevention programs in developing countries; train key personnel for blindness prevention programs; continue to supply reference strains and other material related to laboratory work on Chlamydia trachomatis, limited diagnostic services, and supply information on trachoma diagnosis and control of blinding trachoma; the personnel of the Centre will constitute a cadre of specialists who can be called on to assist WHO or national programs in blindness prevention programs; will support establishment of similar Collaborating Centres in other WHO regions by training and exchange of personnel; and will especially strive to develop similar relationships in Latin America.

(v) WHO Collaborating Centre for Trachoma and
Other Chlamydial Infections
Institute of Ophthalmology
University of London
London,
England

Professor B.R. Jones, Director

Activities of this Collaborating Centre will include training key personnel for programs in the prevention of blindness caused by trachoma, transfer of information on the diagnosis and control of blinding trachoma, and promotion and carrying out of relevant research.

d) Special Programme for Research and Training in Tropical
Diseases
WHO
1211 Geneva 27
Switzerland

Dr. Patricia Rosenfeld

This special program is committed to research in the following areas: malaria, schistosomiasis, filariasis; African Trypanosomiasis, Chagas' Disease, leishmaniasis, leprosy, in addition to epidemiology vector biology and control, biomedical sciences, and socio-economic research. Their commitment to the study of filariasis includes as main goals: the development of new filaricides against Onchocerca volvulus; develop vaccines against filarial infections, general epidemiology of infection, etc.

II. SECONDARY AGENCIES

A. NONGOVERNMENTAL

1. Afro-American Foundation for the Prevention of Blindness
4554 Circle View Boulevard
Los Angeles, California, U.S.A.

Patricia E. Bath, M.D.

2. Canadian National Institute for the Blind
1929 Bayview Avenue
Toronto, Ontario M4G 3E8
Canada

Mr. Ross C. Purse, Managing Director

3. Caritas
Lowenstrasse 3
6002 Lucerne
Switzerland

Mr. Fridolin Kissling, Executive Director

4. C.E.R.P. Department de la Ligue Braille
Rue de l'Argonne 37
1060 Brussels,
Belgium

Mr. Claude Schepens, Le Conseiller-Directeur du Centre

5. Danish Federation for the Blind
Randersgade 68
2100 Copenhagen,
Denmark

Mr. Svend Jensen, President

6. Eye Care Incorporated
Suite One
523 Eighth Street, S.E.
Washington, D.C. 20003, U.S.A.

Mr. E. Timothy Carroll, Director

7. Instituto Internacional Para Ninos
Buschental 3347
Montevideo,
Uruguay

Dr. Eloisa de Lorenzo

8. International Organization Against Trachoma
Paris,
France

Professor G. Coscas, President

9. Middle East Committee for the Welfare of the Blind
P.O. Box 3465
Riyadh,
Saudi Arabia

Mr. Abdullah M. Al-Ghanim, President

10. Netherlands National Association for the Prevention
of Blindness
Oogziekenhuis
Leyweg 295
2545 CJ The Hague,
The Netherlands

11. New Zealand Association of the Blind, Incorporated
3 Lauriston Avenue
Remuera
Auckland 5,
New Zealand

Mr. Cyril C.W. White, Honorary National Secretary-Treasurer

12. Nippon Lighthouse
Welfare Center for the Blind
4-37, Naka 2-chome,
Imazu, Tsurumi-ku
Osaka City, 538
Japan

Mr. Hideyuki Iwahashi, Chief Director

13. Organizacion Nacional de Ciegos
Jefatura
Jose Ortega y Gasset 18
Madrid 6,
Spain

Mr. Pedro Zurita

14. Partners of the Americas
2001 "S" Street, N.W.
Washington, D.C. 20009, U.S.A.

Mr. Gregory L. Dixon, Director

15. Royal National Institute for the Blind
224 Great Portland Street
London W1N 6AA
England

Mr. Eric T. Boulter, Director-General

16. Royal Guide Dogs for the Blind Association of Australia
National Guide Dog & Mobility Training Centre
Chandler Highway, P.O. Box 162
Kew, Victoria 3101
Australia

Mr. J.K. Holdsworth, National Director

17. The Society for Epidemiology and Voluntary Assistance
108 Spring Lake Drive
Chelsea, Michigan 48118, U.S.A.

L. Brilliant, M.D.

18. Swedish Federation of the Visually Handicapped
S-122 88 Enskede
Sweden

Mr. Bengt Lindquist, Executive Director

10. The International Association of Lions Clubs
300 22nd Street
Oak Brook, Illinois 60570, U.S.A.

Mr. W.L. Wilson, Executive Administrator

B. GOVERNMENTAL

1. Canadian International Development Agency
Place du Centre
200 Promenade du Portage
Hull Quebec K1A 0G4
Canada
2. Department of Health, Education and Welfare
Office of International Activities
Social and Rehabilitation Services
Washington, D.C. 20201, U.S.A.
3. Danish International Development Agency
Ministry of Foreign Affairs
Amaliegade, 7, DK-1256,
Copenhagen,
Denmark

4. French Government - Ministry of Cooperation
20 rue Monsier
75700 Paris,
France
5. ICCO
Stadhouderslaan 43
Utrecht,
The Netherlands
6. United States Agency of International Development
515 22nd Street, N.W.
Room 400
Washington, D.C. 20523, U.S.A.

C. INTER-GOVERNMENTAL

1. International Labour Organization
4 Route des Morillons
CH 1211
Geneva 22,
Switzerland

Mr. Norman E. Cooper, Vocational Rehabilitation Section

2. Organization of American States
Educational Affairs
1735 "I" Street, N.W.
Washington, D.C., U.S.A.

Dr. Paul Allard, Director

3. UNESCO
Place Fontenoy
75700 Paris,
France

Mr. N.I. Sundberg

4. UNICEF
866 United Nations Plaza
New York, New York 10017

Dr. L.J. Teply, Senior Nutritionist

III. INTERNATIONAL PROFESSIONAL ORGANIZATIONS

1. International Agency for the Prevention of Blindness
Commonwealth House
Haywards Heath
Sussex RH 16 3AZ
England

Sir John Wilson, President

2. International Council for Education of the Visually Handicapped
Postfach 364
D-6140
Bensheim 1,
West Germany

Mr. Wolfgang A. Stein, International President

3. International Federation of the Blind
c/o Bund der Kriegsblinden Deutschlands
e.V.
Schumannstrasse, 35
5300 Bonn,
German Federal Republic

Dr. Franz Sonntag, President

4. International Federation of Ophthalmological Societies
Eye Clinic of the University
St. Annastraat
Mijmegen,
The Netherlands

Professor Deutman, Secretary

5. International Vitamin A Consultative Group
IVACG Secretariat
The Nutrition Foundation, Incorporated
489 Fifth Avenue
New York, New York 10017

C.O. Chichester, Ph.D.

6. World Council for the Welfare of the Blind
S-122 88 Enskede,
Sweden

Mr. Anders Arnor, Honorary Secretary General

RESOURCES

American Association of Workers for the Blind, Blindness,
(annual publication), 1511 "K" Street, N.W. Washington,
D.C.

American Foundation for the Blind, Journal of Visual Impairment and Blindness, Editor-in-Chief, Mary Ellen Mulholland, 15 West 16th Street, New York, New York 10011

- * Christoffel Blindenmission, Without Holding Hands: Handbook Arising from Seminar held 1978, West Germany, January 1979
- * Helen Keller International, Assessment of the Prevalence of Xerophthalmia in Haiti, Toureau, Serge, Sommer, A. et al 1976
- * Helen Keller International, Assessment of Xerophthalmia and the Mass Vitamin A Prophylaxis Program in El Salvador, Sommer A. 1975
- * Helen Keller International, Evaluation of A Program to Prevent Xerophthalmia in Haiti, Toureau, S., Pizzarello, L., Leone, S. 1979
- * Helen Keller International, An Evaluation of the Vitamin A Deficiency Prevention Pilot Project in Indonesia, Tarwotjo, I., Gunawan, S. et al 1975
- Helen Keller International/Government of Indonesia, Nutrition Blindness Prevention Project Summary Termination Report, Jakarta, June 1979
- * Helen Keller International, Visual Status of Children of Indochinese Refugees Currently Residing in Thailand: Final Report, 1979, Pizzarello, L.
- * Helen Keller International, Xerophthalmia Prevention in the Philippines 1976
- International Council of Education for the Visually Handicapped, Conference Proceedings (every five years)
- * Jaekle, Robert, "Rehabilitation of Blind Persons in Rural India" Journal of Visual Impairment and Blindness, June 1977, Vol 71 No. 6 pp. 241-247
- Perkins School for the Blind, The Educator, (quarterly), Overseas Program in Education of the Blind, Editor, William T. Heisler, 175 North Beacon Street, Watertown, Massachusetts 02172

Royal National Institute for the Blind, The New Beacon: The Journal of Blind Welfare, Editor, Donald Bell, 338-346 Goswell Road, London EC1V 7 JE, United Kingdom

World Council for Welfare of the Blind, Asian Committee, The Asian Blind (quarterly), and Conference Proceedings (every five years)

- * World Health Organization, Blindness Surveillance, Reprinted from WHO Weekly Epidem. Rec. No. 32, No. 33, No. 34, No. 35, No. 36, 1979

World Health Organization, Epidemiology of Onchocerciasis, Report of A WHO Expert Committee, Technical Report Series 597, Geneva 1976

World Health Organization, Field Methods for the Control of Trachoma, Tarizzo, M.L., ed. Geneva 1973

- * World Health Organization, Field Guide to the Detection and Control of Xerophthalmia, Sommer, A., Geneva 1978

World Health Organization, Guidelines for Programmes for the Prevention of Blindness, Geneva, 1979.

- * World Health Organization, "Report of the First Meeting, Geneva, 19-22 February 1979, WHO Programme Advisory Group on the Prevention of Blindness" WHO/PBL/79.1

- * World Health Organization, "Report on the WHO Task Force on the Programme of Research on Control of Vitamin A Deficiency and Xerophthalmia", Manila 22-24 November 1979, Draft Minutes

- * World Health Organization, Special Programme for Research and Training in Tropical Diseases, Second Annual Report: Overview TDR/AR(2)/78.2

- * World Health Organization, Special Programme for Research and Training in Tropical Diseases, Second Annual Report: Scientific Working Group on Filariasis" TDR/AR(2)78.5

- * World Health Organization, Vitamin A Deficiency and Xerophthalmia, Technical Report Series 590, Report of a Joint WHO/USAID Meeting, Geneva 1976

*Being sent to IDRC under separate cover

REPORT ON THE WHO TASK FORCE ON THE PROGRAMME OF RESEARCH
ON CONTROL OF VITAMIN A DEFICIENCY AND XEROPHTHALMIA
Manila, 22-24 November 1979

INTRODUCTION

The Task Force on the Programme of Research on Control of Vitamin A Deficiency and Xerophthalmia met in Manila on 22-24 November 1979. The terms of reference for the Task Force are:

1. To define major problem areas still requiring research relevant to the development of programmes for prevention and control of vitamin A deficiency and xerophthalmia and to suggest those that should receive priority.
2. To assess research activities supported by the programme.
3. To act as a liaison between the Action Oriented Research and Development Programme in Nutrition and the Programme on the Prevention of Blindness.

1.1 The WHO Regional Director, Dr H. Nakajima, opened the meeting and welcomed the group. He stressed the importance of the problems of xerophthalmia and keratomalacia to many countries, particularly some of those in Asia. He emphasized the need to integrate programmes for prevention of xerophthalmia into primary health care in accord with the Alma Ata Conference Declaration. He also stressed the need to integrate such programmes into the newly developing action oriented research and development programme in nutrition and the programme of blindness prevention of WHO.

Dr Pararajasegaram, Chairman, Regional Committee of the International Agency for Prevention of Blindness (South East Asia) was elected Chairman of the meeting of the Task Force. Rapporteurs appointed for the meeting were Dr D.S. MacLaren, University of Edinburgh, and Dr Barbara A. Underwood, Massachusetts Institute of Technology. The Chairman then requested the Secretary, Dr E.M. DeMaeyer, to provide background for the group on the work of WHO in the area of vitamin A deficiency and xerophthalmia and to orient the Task Force to the specific objectives of this meeting.

Background

WHO has been involved with the prevention of nutritional blindness over the last 30 years, and increasingly so since the 1974 WHO/AID meeting in Jakarta and subsequent publication of Technical Report No. 590 (1976) on vitamin A deficiency and xerophthalmia. These events have been followed by additional publications and research in collaboration with other organizations. Planned activities include an expanded programme of assessment surveys to be conducted in 1980.

.../

These expanding activities have coincided recently with the formation of two additional programmes in WHO, the Programme on the Prevention of Blindness and the currently developing Action Oriented Research and Development Programme in Nutrition. All these occurrences have led to the timely appointment of the Task Force on the Programme of Research on the Control of Vitamin A Deficiency and Xerophthalmia.

The specific purpose of the first meeting of the Task Force was to address the first objective of the terms of reference as stated above in the context of the need to integrate the control of vitamin A deficiency and xerophthalmia within the framework of primary health care.

The Task Force looks forward in the future to the opportunity to actively participate in the assessment of the research activities supported by the programme in accord with the second term of reference.

The Task Force also welcomes the opportunity to act as liaison between the Action Oriented Research Programme in Nutrition and the Programme on the Prevention of Blindness and to offer technical guidance to both of these Programmes.

Research Objectives

Research objectives have been developed in the light of the conditions prevailing in developing countries among populations where the problem is prevalent. These conditions include poverty, chronic undernutrition and infection, unhygienic living conditions and other concomitants of social and economic deprivation.

Xerophthalmia is an end point in vitamin A deficiency that describes a level of compromised ocular function. There is little doubt that intervention programmes to raise the level of vitamin A nutriture are needed where xerophthalmia exists. Research relevant to development and implementation of programmes for prevention and control is therefore of high priority.

Animal studies suggest the absence of subclinical signs of deficiency in humans.
Animal studies suggest the absence of subclinical signs of deficiency in humans.
Animal studies suggest the absence of subclinical signs of deficiency in humans.
Vitamin A deficiency (short of ocular symptoms and signs) is associated with compromise of some functions, among which are immunocompetence, hematopoiesis and growth. Evidence is accumulating that similar functional impairments in humans are compromised. Inadequate vitamin A nutriture is defined as that level associated with functional impairment even in the absence of clinical signs of xerophthalmia. As yet that level and indicators that reflect it are imprecisely defined.

Indicies that have been proposed to define a population likely to be "at risk" of functional impairment are as follows:

- a. Dietary intake of young children: < 250-300 ug retinol equivalents/day (FAO/WHO, 1966)
- b. Serum retinol: < 20 ug/dl (IVACG VI, 1978)
- c. Liver vitamin A: < 20 ug/g wet weight (IVACG VI, 1978)

These indicies require validation and refinement. Research is therefore needed:

1. To delineate the relationship between various indicies of vitamin A status (clinical, biochemical and dietary) and functional impairment.
2. To define the relation between serum indicies and liver stores.
3. To provide simpler, safe and non-invasive techniques for assessing liver stores in populations.
4. To define the level of liver stores required for protection from various superimposed stresses such as measles, gastro-enteritis, protein-energy malnutrition, etc.

The Task Force considered that xerophthalmia could be controlled by a number of approaches: - (1) increasing vitamin A intake, (2) controlling those factors that interfere with vitamin A nutriture, and (3) controlling the ocular factors that may precipitate eye lesions. In addition, the Task Force recognized the need for the following activities:

4. Epidemiologic assessment as a basis for designing an intervention programme.
5. Evaluating the process and operation of the programme.
6. Determining the impact of the programme on the problem.

1. INCREASING VITAMIN A INTAKE*

Vitamin A status depends primarily on vitamin A intake but is influenced by a variety of secondary factors. Increasing the intake of vitamin A by whatever means is basic to control of vitamin A deficiency and xerophthalmia.

- 1.1 Increasing Vitamin A Content of the Diet. This is considered the most natural and permanent approach to increased vitamin A intake. Research is needed to determine:
 - 1.1.1 Vitamin A requirements in young children, pregnant and lactating women and women taking oral contraceptives.
 - 1.1.2 Biological availability of carotenoids from vegetable sources and the influence of dietary lipids on the efficiency of their utilization.

* Vitamin A intake as used in this report includes both the precursor carotenoids and the preformed vitamin.

- 1.1.3 Safety of natural sources of carotenoids - with special attention to possible toxic or pharmacologic factors they may contain.
- 1.1.4 The factors that limit the intake of vegetables by young children despite their availability.
- 1.1.5 Methods for encouraging ^{consumption of green leafy vegetable} ~~consumption when they are available by young~~ children. *young children to whom available*
- 1.1.6 Ways to increase availability of sources of vitamin A.
- 1.2 Periodic Supplementation. Because vitamin A is stored in the body, periodic doses of the vitamin will tend to maintain adequate nutriture. This approach is directed toward the most vulnerable groups of the population ~~to be used under~~ *and* special circumstances. Research is needed to determine:
 - 1.2.1 Optimal preparations
 - 1.2.2 Optimal frequency/dose relationships
 - 1.2.3 Side effects, toxicity
 - 1.2.4 Alternative strategies for effective distribution
- 1.3 Fortification. This is a measure directed to the population at large which can be implemented within a relatively short period of time with minimal dependence on active participation of the recipients. Research is needed to:
 - 1.3.1 Develop technology for the fortification of various vehicles.
 - 1.3.2 Develop techniques for monitoring efficiency of the system for delivery of the nutrient.
 - 1.3.3 Study compatibility of nutrients in multiple fortification of a single vehicle.

2. CONTROLLING THOSE FACTORS THAT IMPAIR VITAMIN A NUTRITURE

There is considerable evidence that various secondary factors adversely affect vitamin A nutriture. There is a need, however, to quantify those effects particularly under conditions of marginal or low intake. Research is needed on:

.../

2.1 Factors that impair absorption

2.1.1 Intestinal infections

- a. Giardiasis
- b. Ascariasis
- c. "Gastroenteritis"

2.1.2 Other infections - systemic

2.1.3 Protein-energy malnutrition

2.2 Factors that affect utilization

2.2.1 Systemic infections and febrile diseases, i.e. measles, chickenpox, etc.

2.2.2 Protein-energy malnutrition

3. CONTROLLING THE OCULAR FACTORS CONTRIBUTING TO XEROPHTHALMIA

There is need to identify ocular factors that may contribute to corneal ulceration and melting and to determine their significance and potential for control, i.e. bacterial flora, measles and other viral infections.

4. EPIDEMIOLOGIC ASSESSMENT

The design of intervention strategies requires assessment of the nature, magnitude and distribution of the problem. The assessment must include information on the infrastructure potentially available for implementation of programmes. These data are essential for selection of appropriate interventions, the subsequent evaluation of their efficiency and their impact on the problem. Research is needed in the following areas:

4.1 Clinical Diagnosis

4.1.1 The methodology to assess night blindness, particularly in young children.

4.1.2 Definitive studies of the usefulness of vital stains for early diagnosis using standardized techniques.

4.2 Vitamin A Status

4.2.1 Simple methodology for evaluating serum retinol levels.

4.2.2 The relationship between serum retinol levels and clinical signs.

4.2.3 Simple techniques for assessment of liver stores in representative population samples.

4.3 Dietary Factors

4.3.1 Methods for assessing availability and use of green leafy vegetables for young children.

4.3.2 Identification of potential fortification vehicles.

4.4 The role of vitamin A deficiency and malnutrition in the etiology of corneal destruction associated with measles.

4.5 Methods for evaluating infrastructure and its utilization for implementing intervention programmes

5. EVALUATING THE PROCESS AND OPERATION OF THE PROGRAMME

5.1 Operation^{al} research is needed to determine the efficiency of the intervention.

6. DETERMINING THE IMPACT OF THE PROGRAMME ON THE PROBLEM

Once an intervention programme is established there is need for surveillance to determine its impact and provide for necessary adjustments. Research is needed to determine the usefulness for this purpose of:

6.1 Specially standardized clinical reporting centres

6.2 Periodic limited cross-sectional prevalence surveys

RESEARCH PRIORITIES

While the Task Force has identified ^{the} the above major problems in need of research, priority is given below to those areas where lack of knowledge now most limits implementation of effective control measures.

^R ~~The Task Force~~ assigned relative priorities ^{to the} ~~to the~~ research areas delineated in the first part of this report for control of vitamin A deficiency and xerophthalmia. Within each area the Task Force identified the most important research needs. These are as follows:

Priority Order

1. Increasing the Intake of Vitamin A

- Biological availability of carotenoids from vegetable sources and the influence of dietary lipids on the efficiency of their utilization.

- Alternate ^{and} strategies for effective distribution of periodic supplements.

.../

- The factors that limit the intake of vegetables by young children despite their availability.
- Methods for encouraging ^{consumption of available} green leafy vegetable consumption when ~~they are available~~ by young children.
- Optimal frequency/dose relationships for periodic supplements

2. Epidemiologic Assessment

- The methodology to assess night blindness, particularly in young children.
- Methods for assessing availability and use of green leafy vegetables in diets of young children.
- Simple methodology for evaluating serum retinol levels.
- The role of vitamin A deficiency and malnutrition in the etiology of corneal destruction associated with measles.
- Identification of potential fortification vehicles.

3. Determining the Impact of the Programme on the Problem

- Usefulness of specially standardized clinical reporting centres.

4. Controlling those Factors that Impair Vitamin A Nutriture

5. Vitamin A Deficiency *resulting in subclinical functional impairment*

- Delineation of the relationship between various indices of vitamin A status, clinical, biochemical and dietary, and functional impairment.
- Definition of the relation between serum indices and liver stores.

6. Evaluating the Process and Operation of the Programme

- Operation research to determine the efficiency of the intervention.

7. Controlling the Ocular Factors Contributing to Xerophthalmia



REGIONAL OFFICE FOR THE WESTERN PACIFIC
BUREAU RÉGIONAL DU PACIFIQUE OCCIDENTAL

TASK FORCE ON THE PROGRAMME OF
RESEARCH ON CONTROL OF VITAMIN A
DEFICIENCY AND XEROPHTHALMIA

21 November 1979

Manila, Philippines
22-24 November 1979

LIST OF TEMPORARY ADVISERS AND RESOURCE PERSONS INVITED

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	Dr S.R. Salceda	Philippine Eye Research Institute, Manila
SEARO	Dr D. Karyadi	Director, Nutrition Institute, Djakarta, Indonesia
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PAHO	Dr A. Somner	Helen Keller International New York New York Johns Hopkins Hospital Baltimore, Maryland
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EURO	Dr D.S. MacLaren	University of Edinburgh United Kingdom

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Resource Persons	Dr G. Arroyave	INCAP, Guatemala
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Secretary	Dr E.M. DeMaeyer	WHO, Geneva

TASK FORCE ON THE "PROGRAMME OF RESEARCH
ON CONTROL OF VITAMIN A DEFICIENCY AND
XEROPHTHALMIA"

Manila

22-24 November 1979

AGENDA

1. Opening by the Regional Director
2. Appointment of the Chairman and the Rapporteur
3. Introductory remarks
4. Past and present activities of WHO in the field
of Vitamin A Deficiency
5. Suggestions for future programme of research
6. Approval of the report



WORLD HEALTH ORGANIZATION
ORGANISATION MONDIALE DE LA SANTÉ

SPECIAL PROGRAMME FOR RESEARCH
AND TRAINING IN TROPICAL DISEASES

TDR/AR(2)/78.5

ORIGINAL: ENGLISH

SECOND ANNUAL REPORT:
SCIENTIFIC WORKING GROUP ON FILARIASIS

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ANNEX I. First Report of the Steering Committee of the Scientific Working Group on Filariasis, 23-25 August 1977 (TDR/MPD/SC-FIL(1)/77.3)	
ANNEX II. Report of the Second Meeting of the Steering Committee of the Scientific Working Group on Filariasis, 31 January - 2 February 1977 (TDR/FIL-SC(2)/78.3)	
ANNEX III. Report of the Workshop Meeting on Methods to be used in Chemotherapeutic Trials against Onchocerciasis, 5-9 December 1977 (TDR/FIL/77.1)	

1. STATEMENT OF OBJECTIVES

The main goals of the research programme in filariasis remain as defined in 1977:

- (i) to find new filaricides, especially a non-toxic macrofilaricide for Onchocerca volvulus, microfilaricides less violent in action than diethylcarbamazine, and effective causal chemoprophylactics; and to improve the use of existing drugs;
- (ii) to develop vaccines against the major filarial infections; to find means of reducing the damaging inflammatory reactions that occur in the human host in response to the presence of filarial worms; and to develop simple sero-diagnostic tests of high specificity and sensitivity;
- (iii) to find more suitable animal models for filarial infections and to develop methods of in vitro maintenance and culture, so as to help achieve the goals mentioned in (i) and (ii) above;
- (iv) to study the epidemiology of filarial infections with a view to improving methods of controlling their transmission.

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2. STRATEGIC PLAN

A strategic plan for the first two objectives is presented diagrammatically in Figs. I and II (see pages 3 and 4).

3. SUMMARY OF RESEARCH AND DEVELOPMENT

3.1 Activities outside the Special Programme

Among the main advances in knowledge reported recently and pertaining to filarial diseases the following may be mentioned.

(i) The general opinion among workers who have tested Levamisole against Wuchereria bancrofti and Brugia malayi is that the drug causes more severe reactions than does diethylcarbamazine (DEC); that it is, if anything, less effective; and that it is much less acceptable to the patient.

(ii) In the combined treatment of onchocerciasis using suramin and DEC, the suramin treatment is better tolerated if the drug is given after the main load of microfilariae has been removed with DEC.

(iii) By the time a head nodule has formed in children with African onchocerciasis, much damage has already been done to the eye. Removal of the nodule, although still necessary, usually comes too late to prevent serious visual damage. Some means is required of locating adult worms in the head region before a nodule has been formed, and the possibility that the worms may take up tetracyclines, which could be radio-labelled and thus used for location of the worms, needs to be explored.

(iv) It has been shown that the effect of drugs on microfilariae of Onchocerca volvulus in the cornea can be observed directly through a slit-lamp. The microfilaricidal action can be studied after instilling a drug, in a suitable form, into the eye, and the fellow eye can then be used as a control.

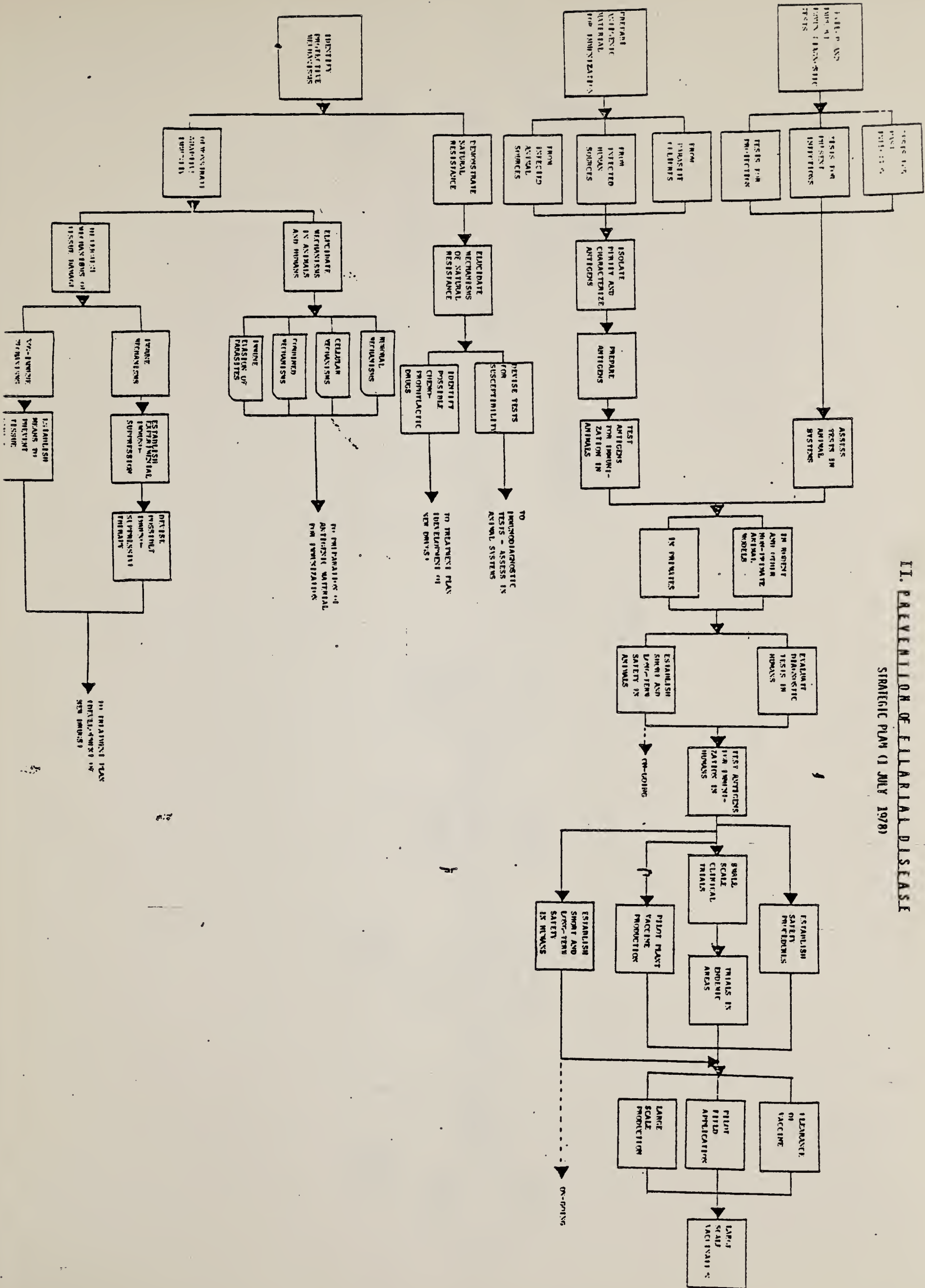
(v) Recent work on Toxocara and other nematodes suggests that exoantigens, secreted or excreted by filarial worms, may well prove to be highly potent and specific - very much more so than are antigens extracted from whole worms. Secretions from both sexes of Dipetalonema viteae have been shown to have marked effects on the concentrations of microfilariae in the blood. The isolation and purification of filarial exoantigens is a field that needs to be explored. Potent antigens of this type might be used to produce specific antisera in animals. These in turn might be used to detect circulating antigens in man thus providing a basis for highly specific and sensitive serodiagnostic tests.

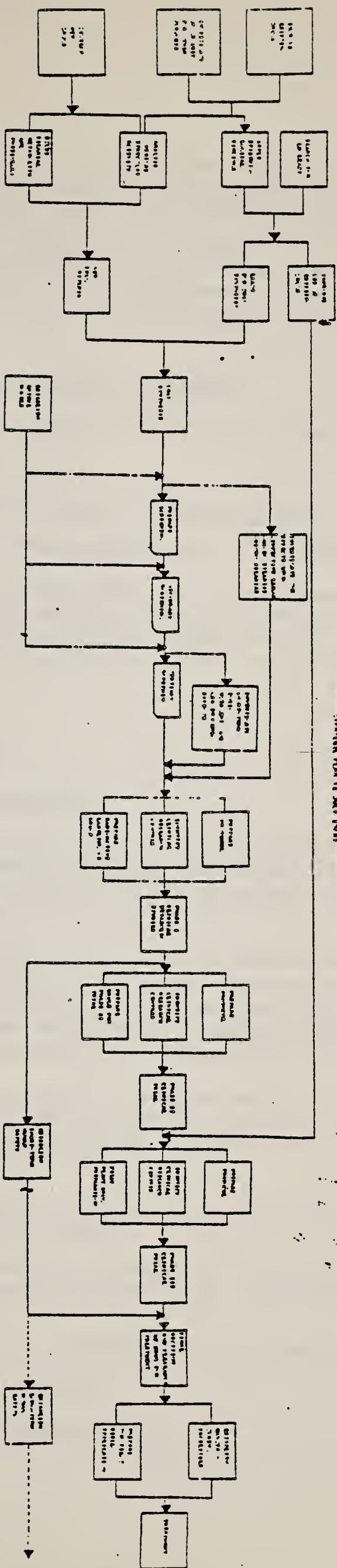
(vi) In Brugia pahangi in cats and in Dirofilaria immitis in dogs a considerable degree of immunity (up to 82% fewer immature and adult filariae) has been demonstrated as a result of using a vaccine composed of irradiated third stage larvae.

(vii) In addition to earlier studies in Taiwan where a nocturnally periodic strain of W. bancrofti was transmitted to monkeys, a rural strain of nocturnal W. bancrofti has also been transmitted with some success (development of mature fecund females, but still no microfilaraemia) to immunosuppressed Malaysian macaques. Further work on these lines should thus be encouraged. If W. bancrofti could effectively be passed to monkeys we might learn the duration of the different stages of the parasite, the population dynamics of the microfilariae, the causal prophylactic potential of DEC, and the exact effect of this drug on the adult worms.

(viii) Further work has been done on the morphological characteristics by which different sibling species of Simulium damnosum s.l. can be identified in the adult

STRATEGIC PLAN (1 JULY 1978)





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stage. The more simple features which were thought to be distinctive a year ago have proved to be of purely local value, but more detailed studies are now revealing general points of distinction which appear to be universally applicable.

(ix) Work on the S. damnosum s.l. reinvasion problem in the Onchocerciasis Control Programme area in the Volta River Basin has opened our eyes to the astonishing range of the wind-assisted "migration" flights made by blood-fed or gravid female flies in the savanna areas of West Africa, and to the importance of these flights in the dissemination of O. volvulus.

3.2 Activities within the Special Programme

The filariasis research programme is now divided into three main divisions:

- (i) chemotherapy;
- (ii) immunology and pathology (including in vitro studies and animal models);
- (iii) field research, epidemiology, and vector studies.

There are signs that the first flush of spontaneous research proposals reaching the Steering Committee is now dying away. The Committee is now engaged more and more actively in searching for new research workers and stimulating them to become involved in filariasis so as to help solve the specific problems which have been identified in the strategic plan.

4. STATUS OF RESEARCH

4.1 Planning and implementation

The SWG has already succeeded in involving a considerable number of established filariasis research workers by inviting semi-spontaneous proposals along certain agreed lines. A reasonably coordinated research programme has begun to take shape, the most solid achievement being in the number one priority area of chemotherapy.

It is now considered that the time has come to identify the still outstanding important problems in filariasis for whose solution major research thrusts will be needed. In future, therefore, increasing importance is attached to workshop-type meetings to discuss these problem areas, to design programmes of research to help solve them, and to identify persons and institutions where these might be carried out.

Some of the problem areas that will be tackled in the future have already been mentioned in this report. For more immediate action it has been decided to devote a large portion of the next SWG meeting (3-6 July 1978) to discussion on three main subjects:

- (i) chemical leads for synthesis of new filaricides (especially in relation to the chemotherapy of onchocerciasis);
- (ii) causes and prevention of reactions to the presence and death of parasites, especially during treatment with filaricides (and particularly in relation to ocular onchocerciasis);
- (iii) requirements for epidemiological field research on filarial infections and their vectors:
 - mosquito-borne filariasis
 - Simulium-borne onchocerciasis

The SWG members invited to attend the July meeting will therefore be selected with a view to their potential contribution to one of these subject areas, as well as for their ability to carry out the statutory overview of the Steering Committee's actions, as laid down by the Technical Review Group II in its 1977 report.

It is felt that a series of small technical meetings of the type just described will greatly assist the SWG in its efforts to put into effect a broadly-based, goal-oriented programme of research that will eventually achieve its objectives.

Since the last annual report there has been no meeting of the Scientific Working Group. The next meeting is due to take place in Geneva, 3-6 July 1978.

The Steering Committee has met twice during the year. Both meetings were held in Geneva, in August 1977 and in February 1978. At the second meeting, the number of members was increased from 7 to 9 in compliance with the recommendations of the Technical Review Group II.

At the time of writing this report the first grantees, who were funded around June 1977, have been working for just under a year, and those funded around December 1977 for just under six months. This section, therefore, describes chiefly work which is planned or in progress.

The visit of Professor C.P. Ramachandran and Professor W.W. Macdonald to a number of institutes in India, Sri Lanka, Burma and Thailand took place in February/March 1978. Their trip served to identify the main problems and research needs in lymphatic filariasis control in many of the highly endemic areas in the countries visited. They were able to identify a number of institutes and scientists who could be involved in problem-oriented research, particularly in the much needed area of epidemiology and vector biology. As a consequence of their visit, it is anticipated that a number of research proposals will be forthcoming from scientists working in filariasis. The report also identifies a number of research institutes which need substantial assistance if they are to become fully functional and productive.

As a follow-up of the visit, a proposal was put forward to hold a Western Pacific and South-East Asia Inter-Regional scientific meeting to discuss research problems related to Culex fatigans-transmitted W. Bancrofti.

The Western Pacific Regional Office of WHO held an informal meeting on "Subperiodic Bancroftian Filariasis", at Apia in Western Samoa in May 1978 attended by three members of the Filariasis SWG Secretariat Team.

4.2 Research operations

4.2.1 Chemotherapy section

Research on chemotherapy has so far been the Committee's number one priority, and it is in this field that the most progress has been made towards establishing a well-organized and coordinated research programme.

The goals of the chemotherapy programme remain as before, namely:

- (i) to determine the best methods of using currently available filaricides;
- (ii) to discover and develop:
 - new improved macrofilaricides (particularly for O. volvulus)
 - new microfilaricides less violent than DEC
 - a filarial chemoprophylactic

The first step towards the first goal involves finding centres in endemic areas where clinical trials can be done and, where necessary, providing radio-labelled drugs to assist with pharmacokinetic and metabolic studies. Leading towards the second goal, which is a much longer-term objective, it has been necessary to secure the cooperation of the pharmaceutical industry, to stimulate lead-directed synthesis for new filaricides, to set up and support filaricide screening centres, and to initiate work on the metabolism of filariae directed towards finding new chemotherapeutic pathways.

4.2.1.1 Collaboration with the Onchocerciasis Control Programme (OCP)

A close liaison has been established between the research branch of OCP and the Special Programme Scientific Working Group on Filariasis. The activities of the OCP have so far concentrated on hospital and field trials using established filaricides mostly within the OCP area; one of the main achievements has been to establish the Chemotherapeutic Centre at Tamale in northern Ghana. Meanwhile, the Special Programme Filariasis SWG has concentrated its activities mainly on the basic research necessary for synthesising, screening and developing new filaricides. At the same time it has sought to promote chemotherapeutic trials at other centres in endemic onchocerciasis areas outside the OCP, and has assisted considerably with the development of the Tamale programme.

In the context of the Onchocerciasis Control Programme, the availability of radical drug treatment for onchocerciasis that is effective, practical and non-toxic would have three great advantages.*

- (i) It would provide rapid relief to those persons already suffering from the disease, especially those under threat of blindness. At present, even with complete interruption of disease transmission following thorough Simulium damnosum control, sufferers are obliged to wait 10-15 years for their onchocerciasis infections to disappear as the adult Onchocerca volvulus worms slowly die off from old age.
- (ii) It would provide an insurance against any possible future development of insecticide resistance on the part of S. damnosum in the OCP area - an occurrence which could otherwise throw the whole control scheme into jeopardy.
- (iii) When, as is hoped, the presently accepted tolerable level of onchocerciasis is achieved throughout the OCP area, and when serious eye lesions and blindness are things of the past, it is probable that standards of tolerability will become ever more critical. At that time, when residual transmission is light, there is likely to be a greatly increased demand for treatment of lightly-infected persons suffering from the severe itching skin lesions of onchocerciasis. For them also improved drug treatment will be needed.

Among the drugs which are available for use in human medicine, and which are known to have a filaricidal action, there is no single one, and no combination thereof, which can at present be used as an alternative to vector control in order to control onchocerciasis. However, given an accelerated clinico-pharmacological research programme, there is some hope that present-day filaricides could be used more effectively and more widely within the OCP area, in order to supplement the effects of vector control by preventing the onset of blindness in those persons who are still at special risk thereof, despite the nearly complete interruption of transmission.

* At present the only acceptable radical treatment of onchocerciasis involves a 2-3 month course of treatment with DEC and suramin, which must be given under medical supervision and which is not without danger to the patient.

On the other hand, the development of a new, effective, non-toxic macrofilaricide having a practical dosage schedule, could alter the picture entirely. Not only could this be used to treat those at high risk of blindness, but it could also be applied on a large scale to reduce the microfilarial reservoir in the human population, thereby contributing to the drop in transmission that has resulted from vector control. In addition, the regular retreatment of reinfected persons would become a possibility.

In the present circumstances, if the OCP is considering a greatly increased financial outlay aimed at developing a practical, effective, non-toxic macrofilaricide for Onchocerca volvulus, there is much to be said for building on the framework already put together by the Filariasis SWG, rather than setting up another programme. This is particularly so, to avoid misunderstandings as well as duplication of effort, when it comes to making approaches to pharmaceutical companies.

To achieve the goal of more effective therapy for onchocerciasis it would seem that we must in the short-term:

- (i) improve the use of existing filaricides;
- and, in the long-term and in order to provide an effective, practical non-toxic macrofilaricide:
- (ii) increase lead-directed chemical synthesis activities;
 - (iii) maintain adequate screening facilities;
 - (iv) stand financially prepared to develop promising new candidate compounds.

4.2.1.2 Collaboration with the Pharmaceutical Industry

Collaboration with the pharmaceutical industry continues to develop satisfactorily. It is based on personal contacts and mutual trust which have been established as a result of personal visits to many companies in Europe, U.S.A. and Japan, made over the last two years by various members of the Steering Committee, of the Secretariat and by other advisers. The principal investigators at the filaricide screening centres supported by the Special Programme have also established their own links with the industry for the supply of compounds to their screens.

It is particularly satisfactory that these contacts have in several instances led to contractual agreements between the company concerned and the Special Programme, based on a carefully negotiated and mutually agreed Letter of Intent dealing with the problems of patents, profits and the further development of any potentially successful filaricides that may be found.

One such agreement has been signed with the Wellcome Foundation, Beckenham, Kent, U.K., enabling Dr J. Keeling, as principal investigator, to set up a filaricide screen for the testing of up to 400 selected compounds annually from the Wellcome Foundation compound library.

Another agreement has been signed with Hoechst AG, Frankfurt-am-Mainz, Federal Republic of Germany. This will enable Hoechst, with the aid of their Dr H. Loewe, to sponsor a programme of chemical synthesis around suramin as a lead compound, which will be carried out by Prof. Nickel at the Department of Chemistry, Free University of Berlin. Any compounds developed will be tested first in the Hoechst filaricide screen and later in the other WHO-supported screens.

It is also gratifying to note that Parke Davis Ltd., in the USA, is now showing a renewed interest in a possible collaborative venture with the Special Programme for

the synthesis of new filaricides; and that visits to several Japanese pharmaceutical companies have resulted in their increased awareness of the needs for drugs in tropical medicine, and hence to a more rational channelling of compounds to the screen maintained by Dr H. Tanaka at the Institute of Medical Science, University of Tokyo.

4.2.1.3 Filaricide screening activities

The supply of compounds, from industry and elsewhere, to the screening centres supported by the Special Programme is still slightly below saturation point, at least while results continue to be negative. Further sources of supply of new compounds are being sought, but it is always wise to have some screening capacity in hand since the further investigation of a positive compound, whenever one is found, can result in much extra work which upsets the screening routine.

Positive results are beginning to come from some screening centres. Professor Lämmler at the University of Giessen, has reported that furazolidone, a nitrofurant derivative used in the treatment of diarrhoea, shows marked macrofilaricidal action against Litomosoides carinii. Arrangements are being made to pass this compound through other screens and, since it is already approved for use in human medicine, to plan tests of its possible action against O. volvulus and W. bancrofti in man.

Pilot investigations into the use of O. gibsoni and O. gutturosa in cattle, as a screen for possible drug action against Onchocerca volvulus, have been successfully carried out by Dr B. Copeman at the Department of Veterinary Science, James Cook University, Townsville, Australia. His results using DEC, levamisole, mebendazole, suramin, etc., indicate that this screen can be used effectively to reveal micro- and macro-filaricidal action.

Large numbers of heavily infected cattle are available at very low prices and the Department has excellent facilities for handling, holding and autopsying these animals. The macrofilaricidal action of a drug can readily be assessed in every detail by histological examination of the 10-30 nodules which are found in each animal, and the similarity of O. gibsoni to O. volvulus, both in regard to the nodules produced and in their response to known filaricides, is remarkable. This screen, therefore, provides an excellent intermediate step between the filarial infections of small rodents and O. volvulus in man.

Dr Copeman has now received further support to extend his work and will endeavour now to investigate ethidium bromide; melarsaronyl potassium; oral melarsoprol; furazolidone; metrifonate; praziquantel; Ciba-Geigy 4540 etc.; combinations of metrifonate, mebendazole and levamisole; other drugs revealed by the Stamford Research Institute literature search (see below); other drugs stemming from the WHO-supported filaricide screening centres; and tetracycline (to see whether it is absorbed by the adult worms).

The cattle Onchocerca model in Australia also offers a means of field-testing drugs for prophylactic action. Almost 100% of calves bred and held in the area become naturally infected with O. gibsoni by the age of seven months, and there are sufficient holding facilities for experiments on these lines to be carried out.

Dr J. McCall of the University of Georgia, working in conjunction with Prof. J. Jaffe, University of Vermont, has also revealed that chlofazimine, a drug used for the treatment of leprosy in man, has a causal prophylactic action against L. carinii and D. viteae at relatively high dosage. Further experiments are now in progress to determine the minimum effective prophylactic regimen. If the results continue to be promising, further experiments will be planned in other animal filarid models, and later perhaps also in man, for action against O. volvulus and W. bancrofti.

In order to increase the collaboration and exchange of compounds between screening centres, to plan for an increased supply of compounds, and to compare methods, problems and new leads, it is planned to organize a Scientific Working Group meeting for the Principal Investigators of the various WHO-supported filaricide screening centres early in 1979.

4.2.1.4 Radio-labelled DEC and suramin

Contracts have now been signed, and work has begun, on the synthesis of both these compounds, labelled with C^{14} in the ring structure. Stamford Research Institute (Dr DeGraw) will provide 5 grammes labelled DEC; and Farbenfabriken Bayer AG (Dr D. Wegner) has agreed to provide 1 gramme of labelled suramin, of which 800 mgs. will be available for work on onchocerciasis and 200 mgs. for work on trypanosomiasis.

One of the first locations where investigations are planned in the pharmacokinetics and metabolism of these compounds in onchocerciasis patients is at the OCP Chemotherapeutic Centre at Tamale in northern Ghana, as part of the already close cooperation established between the Special Programme and OCP.

4.2.1.5 Investigations into methods of use, toxicity, pharmacodynamics and pharmacokinetics of metrifonate, DEC and suramin

Experiments on these lines with metrifonate are already under way, and protocols for the similar careful investigation of DEC and suramin, when used in the treatment of onchocerciasis, are being prepared by the team from the Liverpool School of Tropical Medicine, working closely with Dr K. Awadzi at the OCP Tamale Chemotherapeutic Centre in northern Ghana. They will make use of the radio-labelled compounds mentioned above.

The Committee has also given much thought to the toxic reactions sometimes associated with the use of suramin. It is now endeavouring to arrange for investigations to be made into the stability of suramin under conditions of tropical storage. About 20 samples, comprising different brands of suramin, which have been stored for varying periods at ambient temperature in the tropics, have been sent for analysis by Dr I. Flynn of the Department of Biochemistry, University of Edinburgh Medical School, U.K., using an isotachyphoretic method. Also, to make further investigations into the terminal toxicity of high suramin dosage, attempts are being made to obtain a chimpanzee (an animal which reacts to the drug in a manner similar to man) for an experiment along these lines.

4.2.1.6 Search of the literature of approved drugs for new filaricide leads

The Committee has now received the report prepared on this subject by the Stamford Research Institute (Dr J. DeGraw and Dr W. Colwell). The report provides information on a number of compounds already in use in human medicine, which would be worth testing for filaricidal action in animals or in man. It also provides leads as to groups of compounds which could profitably be selected either for further screening or as points of departure for programmes of synthetic chemistry.

4.2.1.7 Recruitment of post-graduate biochemists to work on folate metabolism of filarial worms in relation to the action of filaricides

Two post-graduate students have now been selected and will shortly start work for two years under Professor J. Jaffe at the University of Vermont, USA. The successful candidates, selected from among eight applicants found after circulating all Departments of Biochemistry in Tropical Africa, are Mr R.A. Acquah, Department of Biochemistry, University of Ghana, and Dr M.M. Iba, a Nigerian presently at the Medical School of the University of Minnesota, USA. Professor Jaffe's programme is

funded in part by the United States National Institutes of Health, and already includes one other post-graduate student from Zaire, whose final year will be funded by the Special Programme.

4.2.1.8 Informal workshop meeting on "Methods to be used in Chemotherapeutic Trials in Onchocerciasis"

This meeting, sponsored by the Special Programme on the advice of the Filariasis Steering Committee, took place at the University of Ibadan in December 1977. It was highly successful in promoting friendly contacts between workers from many parts of the world, in stimulating interest in drug trials for onchocerciasis, in persuading some new workers to enter this field in Africa, in disseminating information on methods, and in laying down guidelines for drug trials. The ethical aspects of such trials received much attention, and the group's considered opinions on them should be of assistance in planning future trials. The report of the meeting is now available from WHO (document No. TDR/FIL/77.1).

4.2.2 Immunology and Pathology (including in vitro culture and animal models)

The main objectives of this section of the programme are:

- (i) the prevention of tissue-damaging lesions in infected persons, especially when parasites are killed during treatment;
- (ii) the development of simple serodiagnostic tests having high specificity and sensitivity;
- (iii) the development of a preventive vaccine.

4.2.2.1 Histopathology of filarial infections

The collection and histopathological study of autopsy and biopsy material from cases of filariasis, especially onchocerciasis, has made steady progress, and it is hoped that this will help fill the great gaps in our knowledge of the pathology of these diseases. More doctors in endemic areas have agreed to collect specimens for dispatch to Dr D. Connor at the United States Armed Forces Institute of Pathology, Washington, USA, which has now been officially designated as the WHO Collaborating Centre for the Histopathology of Filarial Infections in Man. A computerised registry has been set up at the Centre and already over 2,500 specimens have been logged in. The Centre plans to collaborate with Dr T. Orihel at the Department of Tropical Medicine, Tulane Medical Centre, New Orleans, USA, in an investigation of the pathological changes occurring when baboons with very intense Loa loa microfilaraemia are treated with DEC. These experiments may throw light on the severe encephalitic reactions which are sometimes encountered when humans, heavily infected with L. loa, receive treatment with this drug.

4.2.2.2 Host response to filarial infection

To initiate work on the inflammatory reactions to microfilariae in connection with ocular onchocerciasis, Prof. Barrie Jones of the Institute of Ophthalmology, London, has been funded to investigate the inflammatory reactions occurring in the cornea during treatment with DEC and other microfilaricides, and to investigate also the effect of a number of anti-inflammatory agents. It is hoped that this work will be done in the southern Sudan in cooperation with Dr Hadi El Sheikh of the Department of Ophthalmology, Khartoum University.

In order to help draw up a strategy of research on inflammatory reactions to microfilariae, especially in the eye, it is planned to bring this up as one of the subjects

for discussion at the forthcoming meeting of the Scientific Working Group in July 1978. A group of scientists having the necessary expertise has been invited, and three specialists in inflammatory pathology and immunopathology have already visited Geneva to prepare a working paper on the subject.

4.2.2.3 The development of sero-diagnostic tests

A simple but highly specific sero-diagnostic test would be of great value in nocturnally periodic W. bancrofti infections as a means of avoiding night blood surveys. A similar test for O. volvulus infection, but having high sensitivity, could be of great use in identifying uninfected persons in the late stages of Simulium control campaigns as in the Onchocerciasis Control Programme. These lines in the research programme have not yet been developed very far. The value of all sero-diagnostic tests depends largely on the availability of specific and potent antigens. At present, antigens which really satisfy these criteria have not been produced for human filarial parasites. Attempts at antigen isolation and purification have been confined almost entirely to extractions from whole worm material. Recent work on nematode parasites indicates that greater promise lies in the field of exoantigens.

It is proposed at a later date to hold a Scientific Working Group meeting to consider the problems of research on filarial antigens. Meanwhile, one member of the SWG on Basic Biomedical Research has become interested in the problem. Dr Graham Mitchell, an immunologist from the Walter and Eliza Hall Institute, Melbourne, Australia, has an interest in parasite diseases and intends to explore the possibilities of obtaining exoantigens from living Onchocerca gibsoni material in Australia and from living Wuchereria bancrofti material in Papua-New Guinea. Should preliminary studies suggest that the immunological expertise available in this Institute can be adapted to working with antigens from the various stages of filarial worms, he will submit formal research proposals.

4.2.2.4 Development of a vaccine

In this section we are still at the stage of investigating the basic immunological responses that occur in filarial infections - especially those excited by infective larvae - to determine whether any of them might be exploited for the production of a preventive vaccine. There are two main lines of approach:

- (i) basic studies on protective immunity in animal filarial infections which can be rapidly extended to field trials; and
- (ii) studies on the immune response to infective larvae in man.

Among the workers funded in 1977 to undertake basic research on the immune responses to filarial infections in animals, particular satisfactory progress was reported from Professor G.S. Nelson's group at the London School of Hygiene and Tropical Medicine, towards the production of infective larvae of O. cervicalis and O. gutturosa in considerable numbers. New research proposals, linking up with those of Professor Nelson, were received from Dr H.S. Hussein of the Faculty of Veterinary Science, Khartoum. These were approved, in modified form, to provide for a study of the epidemiology and pathology of bovine onchocerciasis under tropical field conditions. Against the background of the knowledge so obtained, it should be possible in future to assess, under field conditions, the effect of a vaccine (based either on irradiated or killed infective larvae) against a species of Onchocerca in ungulates.

Meanwhile, in the field of human onchocerciasis, the work of Dr C. Mackenzie from the National Institute for Medical Research, London, has continued in Cameroon. His findings to date indicate that both a humoral and a cellular response are necessary

to destroy infective larvae and that vaccines are likely to prove ineffective unless they stimulate both components of the response.

4.2.2.5 Research on in vitro maintenance and culture of filarial parasites would greatly facilitate the isolation and study of exoantigens, and would eventually provide a ready supply of material, particularly infective larvae, for work on immunology and for attempts to infect laboratory animals.

Steady progress has been made by Dr R. Howells at Liverpool in testing different culture media for microfilariae and investigating the factors necessary for exsheathment and development in culture. The use of insect cell lines in promoting microfilarial development in culture is now being studied by Dr M.K. Varma at London with the aid of a grant from the Special Programme.

The ability to extract whole live O. volvulus worms from nodules, using collagenase digestion, has opened the way for attempts to maintain adult worms in vitro. Unfortunately, preliminary tests on the digestion of O. gibsoni nodules from cattle indicate that the method cannot yet be applied with this species. It seems probable that bovine collagen is resistant to the collagenases which are at present on the market and which are extracted from Clostridium spp that attack man.

One of the essentials for much of the work on in vitro culture is the need to preserve parasite material alive over the period between its collection in the field and the establishment of a laboratory culture. For this, deep freezing in liquid nitrogen is often necessary. However, the techniques of freezing and thawing are often critical if the parasites are to preserve their full cellular integrity and metabolic potential. It is suggested that a workshop meeting to consider these problems would be a useful exercise to undertake at a later date.

4.2.2.6 Research on animal models

In the western hemisphere the attempts of Dr W. Kozek to infect Patas and other monkeys with O. volvulus have met with no success, and this work is now being extended to a number of other animals, following his move to Colombia. It is hoped that his programme will be linked with similar work about to be undertaken in Guatemala by Dr H. Figueroa, using howler monkeys.

In Africa, at the Institut Ernst Rodenwald in Togo, a programme of research in experimental onchocerciasis has just been started by Dr H. Schulz-Key in close association with the Director of the Institute. This programme has been negotiated in close cooperation with the Federal Republic of Germany's Gemeinschaft für Technische Zusammenarbeit, which will help by providing the services of a medical research officer, a technician and much of the technical equipment necessary. It will also be linked with the activities of the OCP.

Attempts will be made to transplant O. volvulus worms to experimental animals, to investigate changes occurring in the adult worms with age and after treatment with drugs, and to identify the different strains of O. volvulus in West Africa which are linked with differences in transmissibility by various species of S. damnosum s.l., and with different clinical patterns of disease.

4.2.3 Field research, epidemiology and vector studies

Research of this nature can be of great importance and immediate application in improving methods of disease control in the endemic areas. However, it is often difficult to devise research programmes which are both practicable within the resources available and designed to provide answers to specific problems of practical significance to control. For these reasons, it has so far proved difficult to initiate many feasible and worthwhile projects, and an increased effort has gone towards prospecting local disease control problems on a regional basis and finding workers and institutions to investigate them.

4.2.3.1 Epidemiology and control of Bancroftian filariasis in coastal East Africa

Plans for the reorganization of studies on the epidemiology of filariasis, based on the Tanzanian Government/MRC/WHO Helminthiasis Research Unit at Tanga, Tanzania, are being developed. It is hoped that the programme will continue as a joint venture by the Government of Tanzania and the U.K. Medical Research Council, with support from the Special Programme. A new programme will be drawn up within the next few months and key staff will be recruited.

Meanwhile, the work of Dr D.J.B. Wijers on the control of Bancroftian filariasis on Lamu Island off the coast of Kenya by the use of mass DEC distributed through the local village hierarchical system, is making good progress. Dosage of the whole population is nearing completion despite the influx of a considerable number of unexpected refugees from the mainland.

4.2.3.2 Identification of infective larvae of *O. volvulus* in *S. damnosum*

The problem of identifying the infective larvae of various species of Onchocerca (i.e. *O. volvulus* from man and other species from ungulates) in wild caught Simulium is one which closely bears on the accuracy of the Annual Transmission Potential figures by which the effects of Simulium control on the transmission of onchocerciasis are assessed in the OCP. It is thought that a study of isoenzymes in different species and strains of Onchocerca may provide a means of making the necessary distinction. Dr D. Godfrey from the London School of Hygiene and Tropical Medicine has been funded to investigate the possibilities of the method, and he is likely to receive material from a number of different sources in West Africa, including Dr H. Schulz-Key in Togo and the OCP. This work will also be linked with research sponsored by the OCP and carried out by Mr M. Denké in Togo, to investigate the development of various Onchocerca spp from ungulates in *S. damnosum* s.l.

4.2.3.3 Activities in collaboration with WPRO in filariasis research

The report of the WPRO meeting on "Subperiodic Bancroftian Filariasis" (see 4.1) identifies a number of research needs, some of which are of purely regional application, others having wider applicability to lymphatic filariasis control in general. In particular, the results of recent mass DEC campaigns in Tahiti indicate that either annual or four-monthly mass treatment schedules, using single doses of 6 mg/kg, may in the long run be just as effective in reducing clinical disease and microfilarial prevalence rates, and in controlling transmission, as are the more generally accepted regimens involving a total dose of 72 mg/kg.

The Apia meeting is also likely to have generated a number of research proposals to investigate the causes and significance of *W. bancrofti* microfilaraemia persisting at low densities after treatment with DEC in mass campaigns.

A similar meeting, organized jointly by SEARO and WPRO, to deal with the problems of Brugian filariasis may take place in 1979.

5. PLAN OF ACTION FOR 1979

Chemotherapy will remain the number one priority in Filariasis during 1979. Research in immunology, epidemiology and the vectors of filariasis will also be expanded in 1979, to broaden the scientific base of the Scientific Working Group.

5.1 Chemotherapy

Support of existing drug screening centres will be continued and primary screening capacity will be expanded if necessary. The secondary screen in cattle will be further developed. The present "lead-directed" synthesis efforts will be expanded and new compounds for screening will be sought through pharmaceutical companies and other sources. Clinical trial facilities for existing drugs will be expanded to include W. bancrofti and B. malayi. Studies will continue on the methods of use, the toxicity, pharmacodynamics and pharmacokinetics of metrifonate, and similar work will begin on DEC and suramin. Studies will also commence on the metabolism of filarial worms.

5.2 Immunology

Present studies, aimed towards the development of a vaccine, will continue on the basic immunological response in man and on protective immunity in animals - the latter will be extended into field trials should the results warrant it. Current attempts to cultivate microfilariae in vitro will continue and attempts to maintain adult worms in vitro will begin.

5.3 Field research and epidemiology

Planning will be completed for a number of field research projects on lymphatic filariasis and onchocerciasis and activities will begin. Studies in mass DEC chemotherapy will continue (on Lamu Island, Kenya) and epidemiological studies will continue in Tanzania.

5.4 Vectors

Work will begin on the identification of infective larvae of onchocerca in wild caught Simulium.

6. MEMBERSHIP OF STEERING COMMITTEE AND SECRETARIAT TEAM

6.1 Steering Committee

GOODWIN, Dr L.G., Director of Science, Zoological Society of London, London,
United Kingdom (CHAIRMAN)

EL-SHEIKH, Dr H., Khartoum Eye Hospital, Khartoum, Sudan

HENRY, Dr D., The Wellcome Research Laboratories, Burroughs Wellcome Company,
Research Triangle Park, North Carolina, United States of America

KALE, Dr O.O., Department of Preventive and Social Medicine, University of
Ibadan, Ibadan, Nigeria

NELSON, Dr G.S., Department of Medical Helminthology, London School of Hygiene
and Tropical Medicine, London, United Kingdom

OGILVIE, Dr B.M., National Institute for Medical Research, London,
United Kingdom

SASA, Dr M., National Institute for Environmental Studies, Ibaraki, Japan

6.2 WHO Secretariat Team

DUKE, Dr B.O.L., Chief, Filarial Infections, Division of Malaria and Other
Parasitic Diseases, World Health Organization, Geneva, Switzerland
(SECRETARY OF SWG)

BUCK, Dr A.A., Chief, Research Coordination, Epidemiology and Training, Division of
Malaria and Other Parasitic Diseases, World Health Organization, Geneva,
Switzerland

DE MAAR, Dr E., Division of Prophylactic, Diagnostic and Therapeutic Substances,
World Health Organization, Geneva, Switzerland

HAMON, Dr J., Director, Division of Vector Biology and Control, World Health
Organization, Geneva, Switzerland

MARR, Mr D.M., Onchocerciasis Control Programme in the Volta River Basin, World
Health Organization, Geneva, Switzerland

TORRIGLIANI, Dr G., Chief, Immunology, Division of Noncommunicable Diseases, World
Health Organization, Geneva, Switzerland

7. MEETINGS HELD AND PLANNED

1977

- Steering Committee of the Scientific Working Group on
Filariasis 23-25 August
- Workshop meeting on methods to be used in chemotherapeutic
trials against onchocerciasis 5-9 December

1978

- Steering Committee of the Scientific Working Group on
Filariasis 31 January -
2 February
- Scientific Working Group on Filariasis 3-6 July
- Steering Committee of the Scientific Working Group on
Filariasis 7-8 July

PROGRAMME AREA 11: RESEARCH AND DEVELOPMENT - OPERATIONS

COMPONENT: **FILARIASIS**SCIENTIFIC WORKING GROUP OR COMPONENT SECTION: **CHYMOTIFRAPHY**

8. LIST OF FUNDED PROJECTS

Project Number	Project Title	Principal Investigator and Institute	Start- ing Date	Comple- tion Date	Total Cost US \$	B U D G E T S				
						1975	1976	1977	1978	1979 ¹
770049	Experimental chemotherapy of filariasis and screening of filaricides	LAMMELER, Dr G. Institut für Parasitologie Justus Liebig-Universität Rudolf-Buchheimstrasse 4 D-6300 Giessen, Federal Republic of Germany	1977	1979	237 000			92 000	70 000	75 000
770050	Experimental chemotherapy of filariasis and screening of filaricides	McCALL, Dr J. W. Department of Parasitology University of Georgia Athens, Georgia 30602, USA	1977	1979	195 000			62 000	65 000	68 000
770052	Experimental chemotherapeutic research on filariasis and screening of filaricides against <u>Brugia pahangi</u>	DENHAM, Dr D. A. Department of Helminthology London School of Hygiene & Tropical Medicine Keppel Street (Gower Street) London WC1 7HT, UK	1977	1979	135 000			42 000	45 000	48 000
770060	Review of structure-activity relationships of drugs for treatment of filarial diseases	CORY, Dr M. Bio-Organic Chemistry Department Stanford Research Institute Menlo Park, California 94025, USA	1977	1977	25 000			25 000		
770063	Control of DEC reactions in <u>D. immitis</u> infected dogs	DESOWITZ, Professor R.S. Department of Tropical Medicine & Medical Microbiology University of Hawaii 3675 Kilauea Avenue Honolulu, Hawaii 96816, USA	1977	1977	2 000			2 000		
770061	Synthesis of radio-labelled diethylcarbamazine citrate	DeGRAW, Dr J. I. Bio-Organic Chemistry Department Stanford Research Institute Menlo Park, California 94025, USA	1977	1977	16 000			16 000		
770067	Filariasis chemotherapy - development of biological test systems and screening of filaricides	KEELING, Dr J. E. D. Wellcome Research Laboratories Langley Court Beckenham, Kent, UK	1977	1979	190 000			54 000	63 000	73 000
770387	Letter of Intent/Agreement: Synthesis of filaricidal compounds (Suramin)	WAGNER, Dr W. H. Hoechst AG 6230 Frankfurt (M) 80 Federal Republic of Germany	1978	1978	50 000				50 000	

¹ Budget estimates subject to adequate progress and availability of funds

SCIENTIFIC WORKING GROUP OR COMPONENT SECTION: CHEMOTHERAPY

8. LIST OF FUNDED PROJECTS

Project Number	Project Title	Principal Investigator and Institute	Start- ing Date	Comple- tion Date	Total Cost US \$	B U D G E T S				
						1975	1976	1977	1978	1979 ¹ 1980 ¹
770068	Preliminary screening of compounds as filaricides against <i>Litomosoides carinii</i> , <i>Dipetalonema viteae</i>	TANAKA, Dr H. Institute of Medical Science University of Tokyo 4-6-1 Shirogane-dai, Minato-ku Tokyo 108, Japan	1977	1979	40 000			10 000	15 000	15 000
760026	Folate metabolism of filariae	JAFFE, Dr J.J. Department of Pharmacology, University of Vermont College of Medicine Given Building Burlington, Vermont 05401, USA	1978	1980	66 000				27 000 12 000	13 000 14 000
770069	Studies of the filaricidal action of Levamisole and its analogues and of DEC in vitro and in vivo	ZAMAN, Professor V. Department of Parasitology Faculty of Medicine University of Singapore Singapore 3, Singapore	1977	1977	5 000			5 000		
760002	Development of methods for screening drugs against <i>Onchocerca gibsoni</i> and <i>O. gutturosa</i> in cattle	MOORHOUSE, Dr D. E. Department of Parasitology University of Queensland St Lucia, Brisbane, Australia	1976	1976	5 000		5 000			
770072	Development of methods for screening drugs against <i>Onchocerca gibsoni</i> and <i>O. gutturosa</i> in cattle	COPEMAN, Dr D. B. Department of Tropical Veterinary Science James Cook University of North Queensland Townsville, Queensland 4811, Australia	1977	1980	143 000			5 000	45 000	48 000
770078	Clinical, therapeutic and epidemio- logical investigations in onchocerciasis	KALE, Dr O. O. Department of Preventive and Social Medicine University of Ibadan Ibadan, Nigeria	1977	1979	81 000			29 000	29 000 ¹	23 000
770080	Synthesis of radio-labelled auramin (<i>O. volvulus</i>) (see project funded under trypanosomiasis, \$10 000)	WERNER, Dr H. G. Bayer AG Pharma Forschungszentrum Ressort Medizin, Aprather Weg D-5600 Wuppertal 1, Federal Republic of Germany	1977	1977	40 000			40 000		
Total chemotherapy component						5 000		382 000	329 000 ²	360 000 62 000

¹ Budget estimates subject to adequate progress and availability of funds² The total includes only those projects actually funded as of 30 June 1978

PROGRAMME AREA 11: RESEARCH AND DEVELOPMENT - OPERATIONS

COMPONENT: F.I.L.A.R.I.A.S.I.S. (CONT.)

SCIENTIFIC WORKING GROUP ON COMPONENT SECTION: IMMUNOLOGY/PATHOLOGY

8. LIST OF FUNDED PROJECTS

Project Number	Project Title	Principal Investigator and Institute	Start- ing Date	Compl- tion Date	Total Cost US \$	B U D G E T S				
						1975	1976	1977	1978	1979 ¹
770047	Immunological studies on filariasis in special relation to occult filariasis	ZAMAN, Professor V. Department of Parasitology Faculty of Medicine University of Singapore Singapore 3, Singapore	1977	1979	87 000			41 000	23 000	23 000
770051	Immunological studies on filariasis and factors affecting resistance to infection	SUBRAMANYAM, Professor D. Department of Biochemistry Postgraduate Institute of Medical Education & Research Chandigarh, India	1977	1979	128 000			88 000	20 000	20 000
770056	Immunological studies in filariasis - factors affecting resistance to infection	NELSON, Dr D. S. Kolling Institute of Medical Research Royal North Shore Hospital St Leonards, NSW 2065, Australia	1977	1979	13 000			4 000	4 500	4 500
770057	Immunological investigations in rodent filariasis	WENK, Professor P. Tropenmedizinisches Institut Wilhelmstrasse 11 7400 Tübingen 1, Federal Republic of Germany	1977	1979	60 000			20 000	20 000	20 000
770058	Immunology of a subcutaneous filarid	NEILSON, Professor J. T. M. College of Veterinary Medicine University of Florida Gainesville, Florida 32611, USA	1977	1979	66 000			20 000	22 000	24 000
770065	Etude de l'immunité humorale et cellulaire à <u>W. bancrofti</u>	PARC, Dr F. Unité de biologie Médicale de l'Institut Louis Malardé Institut de Recherche Médicales Louis Malardé B.P. 30 Papeete, Polynésie française	1977	1978	20 000			10 000	10 000	
770066	Immunopathogenesis of lymphatic lesions due to <u>Brugia pahangi</u> in jirds	KLEI, Dr T. R. Department of Veterinary Microbiology & Parasitology School of Veterinary Medicine Louisiana State University Baton Rouge, Louisiana 70803, USA	1977	1979	67 000			20 000	22 000	25 000
780027	Immunological responses in the Patas monkey during infection with <u>Brugia malayi</u>	CRANDALL, Professor R.B. University of Florida Gainesville, Florida 32611, USA	1978	1980	18 300				7 500	5 100
										5 700

¹ Budget estimates subject to adequate progress and availability of funds

COMPONENT:..... F.I.L.A.R.I.A.S.I.S..... (CONT.)
 SCIENTIFIC WORKING GROUP OR COMPONENT SECTION:..... IMMUNOLOGY/PATHOLOGY.....

8. LIST OF FUNDED PROJECTS

Project Number	Project Title	Principal Investigator and Institute	Start- ing Date	Comple- tion Date	Total Cost US \$	B U D G E T S				
						1975	1976	1977	1978	1979 ¹
760001	Study of cellular and humoral mechanisms involved in the destruction of <i>O. volvulus</i> infective larvae with a view to finding antigens suitable for vaccine purposes	OGILVIE, Dr B. M. Division of Parasitology National Institute for Medical Research Mill Hill London NW7 1AA, UK	1976	1979	69 000		8 000	5 000 26 000	15 000 ¹	15 000
770074	Experimental studies on <i>Loa loa</i> and <i>Onchocerca volvulus</i> in primates and other animals	ORIHIEL, Dr T. Delta Regional Primate Center Tulane University New Orleans, Louisiana 70112, USA	1977	1979	61 000			29 000	15 000	17 000
770075	Laboratory and field studies on <i>Onchocerca cervicalis</i> and <i>O. gutturosa</i> towards development of a preventive vaccine	NELSON, Professor G.S. Department of Helminthology London School of Hygiene and Tropical Medicine Keppel Street (Gower Street) London WC1E 7HT, UK	1977	1979	108 000			28 000	40 000	40 000
780029	Laboratory and field studies on the pathology, immunology and chemotherapy of onchocerciasis of cattle and equines in the Sudan	HUSSEIN, Dr H. S. Department of Microbiology and Parasitology Faculty of Veterinary Science University of Khartoum North P. O. Box 32 Khartoum, Sudan	1978	1980	78 000				20 000	28 000
770073	In vitro maintenance of cattle <i>Onchocerca</i> spp.	HUTCHINSON, Dr G. W. Department of Tropical Veterinary Science James Cook University of North Queensland Townsville, Queensland 4811, Australia	1977	1977	2 000			2 000		
780156	Antigen development and antibody levels in <i>Wuchereria bancrofti</i> infections	DISSANAYAKE, Dr S. Department of Biochemistry Faculty of Medicine University of Sri Lanka Peradeniya Campus 8301 Kandy, Sri Lanka	1978	1980	21 900				18 200	3 100
Total immunology/pathology component						8 000		293 000	147 200 ²	224 700
										36 300

¹ Budget estimates subject to adequate progress and availability of funds

² The total includes only those projects actually funded as of 30 June 1978

PROGRAMME AREA II: RESEARCH AND DEVELOPMENT - OPERATIONS

8. LIST OF FUNDED PROJECTS

COMPONENT: FILARIASIS

(CONT)

SCIENTIFIC WORKING GROUP OR COMPONENT SECTION: EPIDEMIOLOGY, ENTOMOLOGY, PARASITOLOGY

Project Number	Project Title	Principal Investigator and Institute	Start- ing Date	Comple- tion Date	Total Cost US \$	B U D G E T S				
						1975	1976	1977	1978	1979 ¹ 1980 ¹
780024	In vitro culture of human filariae using insect cell lines	VARMA, Dr M. G. R. Department of Entomology London School of Hygiene & Tropical Medicine Keppel Street (Gower Street) London WC1E 7HT, UK	1978	1980	47 000				14 000	15 000
770053	In vitro culture of filarial worms	HOWELLS, Dr R. E. Department of Parasitology Liverpool School of Tropical Medicine Pembroke Place Liverpool L35QA, UK	1977	1979	49 000			17 000	16 000	16 000
770062	Development of a model filarial infection in birds	RAMALINGAM, Dr S. Department of Parasitology Faculty of Medicine University of Malaya Kuala Lumpur, Malaysia	1977	1979	11 000			4 300	3 500 ¹	3 200
770071	Studies on in vitro cultivation of <i>Onchocerca volvulus</i> and search for exoantigens	SCHILLER, Professor E. L. Johns Hopkins University School of Hygiene and Public Health 615 North Wolfe Street Baltimore, Maryland 21205, USA	1977	1977	33 000			23 000 10 000		
770076	Attempts to establish <i>Onchocerca volvulus</i> infection in small laboratory animals	KOZEK, Dr W. J. Tulane School of Tropical Medicine and Public Health 1430 Tulane Avenue New Orleans, Louisiana 70112, USA	1977	1979	21 500			7 500	7 000 ¹	7 000
770079	In vitro culture and parasitological investigations of <i>Onchocerca volvulus</i>	RUTTNER, Dr D. W. Bernhard-Nocht-Tropeninstitut Bernhard-Nocht-Strasse 74 D-2 Hamburg 4, Federal Republic of Germany	1977	1979	147 000			49 000	49 000 ¹	49 000
780028	Characterization of <i>Onchocerca</i> spp. by isoenzymes	GODFREY, Dr D. G. Department of Medical Protozoology London School of Hygiene and Tropical Medicine Keppel Street (Gower Street) London WC1E 7HT, UK	1978	1980	51 000				14 500	17 000
Total epidemiology, entomology, parasitology component								110 800	44 500	107 200 ²
										37 500

¹ Budget estimates subject to adequate progress and availability of funds

² The total includes only those projects actually funded as of 30 June 1978

COMPONENT:.....**FILARIASIS**.....(CONT.)
 SCIENTIFIC WORKING GROUP OR COMPONENT SECTION:.....**IN VITRO AND ANIMAL MODELS**.....

PROGRAMME AREA II: RESEARCH AND DEVELOPMENT - OPERATIONS

8. LIST OF FUNDED PROJECTS

Project Number	Project Title	Principal Investigator and Institute	Start- ing Date	Comple- tion Date	Total Cost US \$	B U D G E T S				
						1975	1976	1977	1978	1979 ¹
770048	Exchange of letters: Morphological studies on <u>Filarid</u> parasites in insect vectors	ZAMAN, Professor V. Department of Parasitology Faculty of Medicine University of Singapore Singapore 3, Singapore	1977	1977	8 700			8 700		
770054	Genetics of <u>Culex fatigans</u> susceptibility to <u>Wuchereria bancrofti</u>	SERVICE, Dr M. W. Department of Medical Entomology Liverpool School of Tropical Medicine Pembroke Place Liverpool L35QA, UK	1977	1979	38 000			12 000	12 000 ¹	14 000
770055	Control of <u>Bancroftian filariasis</u> on the islands off the Kenya coast by mass treatment with diethylcarbamazine Exchange of letters: Mass treatment of <u>Wuchereria bancrofti</u> on Lamu Island	WIJERS, Dr D.J.B. Medical Research Centre Royal Tropical Institute of Amsterdam P.O. Box 20752 Nairobi, Kenya	1977	1978	17 000			12 000	5 000	
770059	Printing computerized bibliography on <u>filariasis</u>	NELSON, Professor G.S. London School of Hygiene & Tropical Medicine WHO Collaborating Centre for the Filarioides Keppel Street (Gower Street) London WC1 7HT, UK	1977	1977	16 000			16 000		
770064	Sélection de souches d' <u>Aedes</u> <u>polynesiensis réfractaires à</u> <u>W. bancrofti</u>	PICHON, Dr G. Institut de Recherches Médicales Louis Malardé B.P. 30 Papeete, Polynésie française	1977	1979	75 600			25 600	24 000 ¹	26 000
770077	Exchange of letters: Research on ocular onchocerciasis	JONES, Professor B. Institute of Ophthalmology Moorfields Eye Hospital City Road London EC1V 2PD, UK	1977	1977	3 200			3 200		
Total in vitro and animal models component								77 500	5 000 ²	40 000

¹ Budget estimates subject to adequate progress and availability of funds

² The total includes only those projects actually funded as of 30 June 1978

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